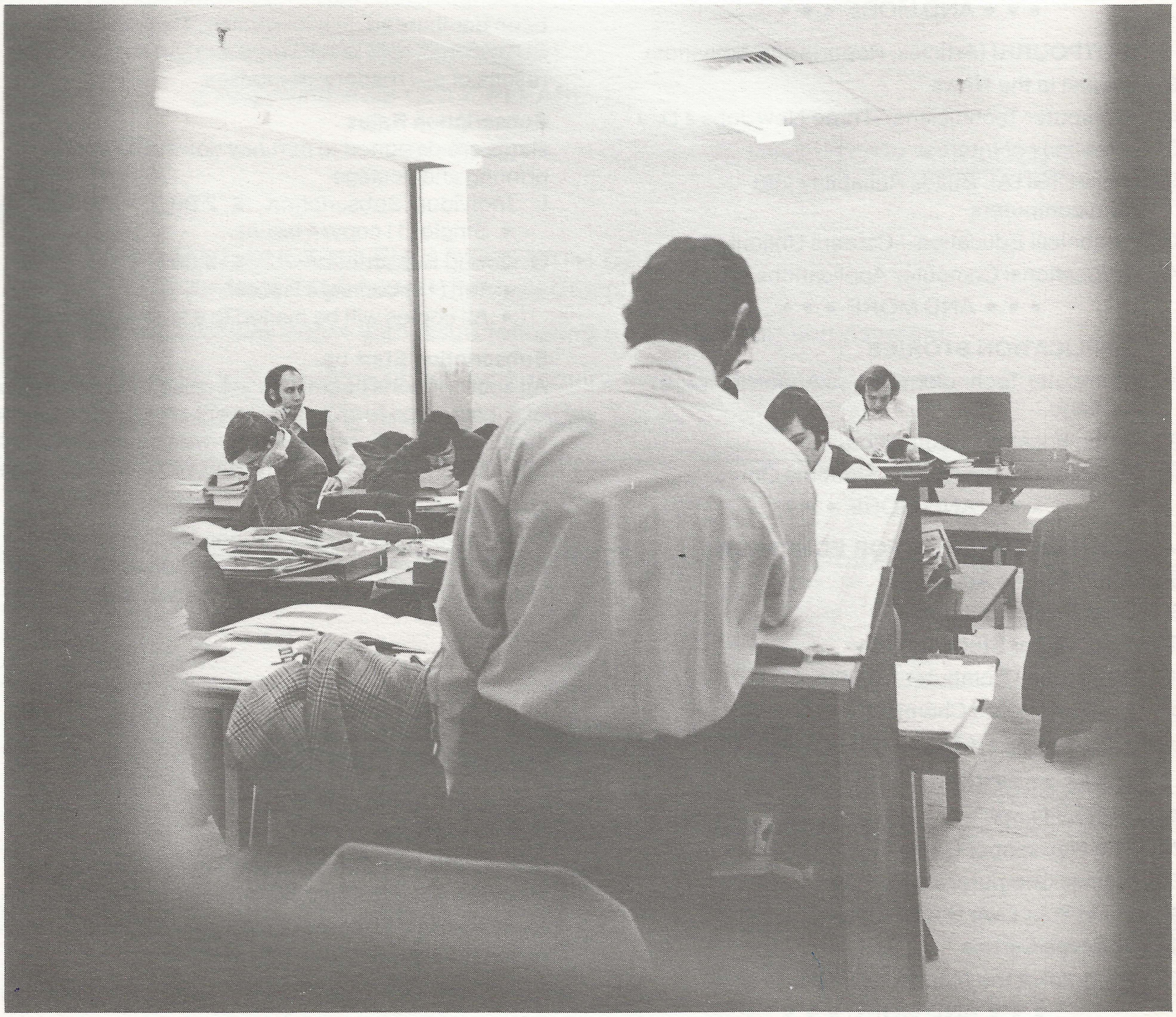
digital
146 Main Street
Maynard, Massachusetts 01754

edu

number 9
fall 1973

SUBSCRIPTION NOTICE

See Page 2 of this issue



"The general educator must become committed to playing in the vocational ballpark. No other ballgame holds as much potential for integrating the educational effort and providing our young people with a meaningful school experience."

—W. Wesley Tennyson

THIS ISSUE OF EDU FEATURES CAREER EDUCATION

Vocational-Technical Education, Computer Technology, Applications and Ideas

THIS ISSUE OF EDU CAREER EDUCATION

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CREDITS—ART AND PHOTO

Illustrations: Bob Barner, 52 Temple Street, #6,
Boston, MA. 02114

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Rochester, N.Y.
Digital Equipment Corp.

SUBSCRIPTION NOTICE

In EDU #8, we published a questionnaire and subscription renewal form; over the summer we have been bombarded (!!) with returns. This new EDU SUBSCRIPTION POLICY is based on the tabulated results of our readers' responses.

Subscription Rates

Rates are designed to partially defray the cost of printing and postage.

I: Individual Subscription $ 2.00.
- Single (1) copy/4 issues.

G: Group Subscription $15.00.
- Ten (10) copies/4 issues.
- All copies will be mailed to a single address.

Subscription Start-up

All subscriptions begin with the issue following receipt of subscription form and payment and continue through 4 issues. Subscriptions are renewed on an annual basis. See "EDU SUBSCRIPTION FORM" on the last page.

Back Issues

Every EDU will contain a coupon for ordering back issues. A charge of 50¢ will be applied to each copy. See "COLLECTOR'S COUPON" on the last page.

PUBLISHER'S STATEMENT

EDU—ISSUE #9: Fall 1973.
Editors of this issue:

Ronald Robert Edwards, Assistant Professor of Mathematics, Westfield State College, Westfield, MA.

Warren H. Hill, Associate Professor of Mathematics, Westfield State College, Westfield, MA.

Sally Richards Bower, Digital Equipment Corporation

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(ten copies to same address)

EDU welcomes contributions from its readers. Send to: Editor, EDU, at the above address.

ALL GONE

Our Flip Chip Module offer from EDU #7 was such a success that we ran out! No more for now, folks.

PLEASE: Stop sending us your orders. We'll announce availability of these and other obsolete items in some future issue of EDU!

QUOTE FOR CAREERS

"Between two people applying for any job with our company, the one with some knowledge of computers will get the job, all other considerations being equal."

Anonymous personnel director of a
major Seattle-based company.

CORRECTION: Our apologies to Mr. Chaim Mardiks of The Center for Educational Technology, Herzlia, Israel, who is the actual author of The Program of The Month published in EDU #8. Our mistake.

CANADIAN ORDER INFORMATION

For the convenience of our Canadian customers, DIGITAL has established an ordering address for all manuals and curriculum materials. Any of our standard educational items may be purchased from:

Digital Equipment of Canada, Ltd.
100 Hertzberg Road
Kanata, Ontario
Attention: Dorothy Clarke

CONTRIBUTIONS

We know how hard it is to take the time to send your contributions to EDU. Especially now, when you're busy preparing courses for this term or school year! But EDU *needs* input from its readership...Do EDU and your fellow-educators a favor. Make a new-school-year resolution to write at least one letter to EDU this year... Okay? Talk about anything...your installation, your computer instructional programs or your ideas...for all levels of instruction from grade school to college and university. Typed or hand-written materials will be accepted—send us edited or unedited material. And if you need some ideas, look at our back issues of EDU, or write something for the following categories:

SPEAK OUT (Contributions, Opinion and Letters to the Editor)

PRODUCTS AND NEWS (Book reviews, classroom aids, other people's products, anything new for classroom computing).

APPLICATION BRIEFS (Stories about your installation, applications at any level).

SOURCE MATERIAL FOR EDUCATORS (Books, papers, articles, ideas and materials).

CONFERENCES AND REPORTS (Meetings of interest, articles, reports and stories [original or borrowed!]).

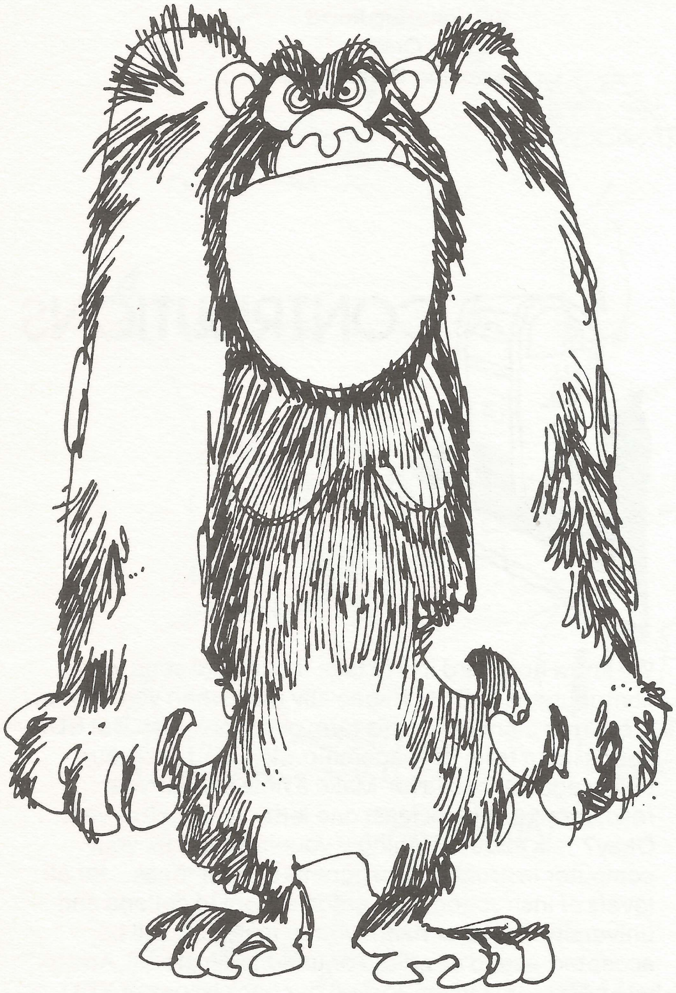
IDEAS AT WORK (Classroom ideas, hints for teaching).

Send your letter, article and/or materials to EDU, Editor, Education Products Group 5-5.

And thanks.

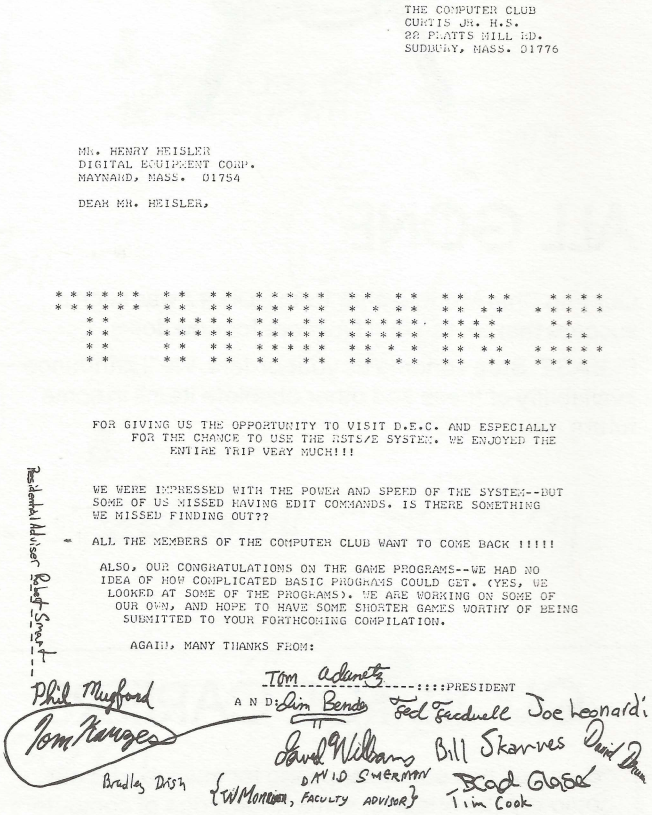
SPEAK OUT

(Contributions, Opinions and Letters to the Editor)



CORRESPONDENCE CORNER

The Curtis Junior High School (Sudbury, MA) Computer Club was recently invited to work with the PDP-11 RSTS/E demonstration system at DIGITAL, Maynard. Curtis students currently use an EduSystem 20. The day in Maynard gave club members the opportunity to test larger programs on the RSTS system. We thought their letter of appreciation was original and worthy of reprint!



THE COMPUTER CLUB
CURTIS JR. H.S.
22 PRATTS MILL RD.
SUDBURY, MASS. 01776

MR. HENRY HEISLER
DIGITAL EQUIPMENT CORP.
MAYNARD, MASS. 01754

DEAR MR. HEISLER,

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* * * * * *   * *   * *   * * * * *   * *   * *   * *   * *     * * * *
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FOR GIVING US THE OPPORTUNITY TO VISIT D.E.C. AND ESPECIALLY FOR THE CHANCE TO USE THE RSTS/E SYSTEM. WE ENJOYED THE ENTIRE TRIP VERY MUCH!!!

WE WERE IMPRESSED WITH THE POWER AND SPEED OF THE SYSTEM--BUT SOME OF US MISSED HAVING EDIT COMMANDS. IS THERE SOMETHING WE MISSED FINDING OUT??

ALL THE MEMBERS OF THE COMPUTER CLUB WANT TO COME BACK !!!!!

ALSO, OUR CONGRATULATIONS ON THE GAME PROGRAMS--WE HAD NO IDEA OF HOW COMPLICATED BASIC PROGRAMS COULD GET. (YES, WE LOOKED AT SOME OF THE PROGRAMS). WE ARE WORKING ON SOME OF OUR OWN, AND HOPE TO HAVE SOME SHORTER GAMES WORTHY OF BEING SUBMITTED TO YOUR FORTHCOMING COMPILATION.

AGAIN, MANY THANKS FROM:

Tom Adametz----------::::PRESIDENT

A N D: Jim Bender

Ted Treadwell Joe Leonardi

Phil Mugford

Tom Kanges

David Williams Bill Skarves

DAVID SHERMAN

Bradley Drish

{W Morrison, FACULTY ADVISOR}

Brad Glaser

Tim Cook

Residential Adviser Robert Smart

CLASSIFIEDS

READERS: This is *your* section. We'll run your ad here FREE if you're a school or non-profit organization. Got some older equipment you'd like to sell, a useful software package, or some other service you'd like to share? We'll also run want ads—looking for hardware, software, part-time labor, etc.?

VT05 USERS: Let's swap programs written in BASIC using CAD instruction. What have you?
Chase Ambler, Asheville School,
Asheville, N.C. 28806

"...We must learn to honor excellence...(indeed to demand it) in every socially accepted human activity, however humble the activity, and to scorn shoddiness, however exalted the activity...An excellent plumber is infinitely more admirable than an incompetent philosopher. The society which scorns excellence in plumbing because plumbing is a humble activity and tolerates shoddiness in philosophy because it is an exalted activity will have neither good plumbing nor good philosophy. Neither its pipes nor its theories will hold water."

John W. Gardner, EXCELLENCE

DEVELOPING EXCELLENCE IN AMERICAN EDUCATION

by Russell L. Heiserman

Our society has in its own mind established an exact equation for success: high school + college = success. This equation is believed by most parents, many teachers and most college bound students. Therefore, since high school is an integral part of this equation—high school does have meaning for the college bound student or about 40 per cent of the students entering the school system. A college prep program certainly has no relevance for the high school dropout and no real relevance for most high school graduates that do not seek further education. Perhaps this is one point of discontent in our educational system. I believe we all agree that a large majority of our school dropouts and high school graduates are ill prepared for careers in our technical society, and that most students in this category realize it. This is a correctable situation.

Now we turn our attention to those students that go on to college, 40%, with 20% getting to the baccalaureate degree. A sizable segment of these students enter college through junior colleges and more will in the future. These should be good students (all high school graduates) with high motivations and career direction. However, statistics indicate* that two-thirds of the students entering junior college classify themselves as "transfer" students with plans to go on to four year college. However, only about one-third of those entering students actually transfer to four-year colleges; most end up as terminal cases entering the labor market with still a lack of developed saleable skills. The reason that students tend to follow this fruitless route is charged to cultural, parental and prestige values associated with the baccalaureate degree. The all American equation: high school + college = success. Certainly this post-high school misguided frustration is a source of dissension.

Therefore, we may summarize by saying that one area of dissension in our schools is based on inappropriate guidance and education for the majority of our young, and this in turn is based on a general assumption that a college education will benefit *all* students.

Another source of dissension is the fight for equality of minority groups. These are the ethnic groups and the classroom teacher. Both have found it hard to find equal opportunity in our affluent society. Salaries have increased in recent years for school teachers, but in an interesting manner. Most salary increases have been of the across-the-board nature with little reward for the excellent teacher doing an outstanding job. The excellent teacher is still frustrated. Teaching has traditionally been an easy profession to enter, requiring only paper qualifications and a willingness to live on short pay. The pay situation is being corrected but our criteria for selecting those entering and practicing our honored profession has not. In my own opinion, a large number of teachers were overpaid for what they *accomplished* even before the recent round of pay increase. Now they are simply tremendously overpaid for what they *accomplish* while the excellent teacher is still poorly compensated.

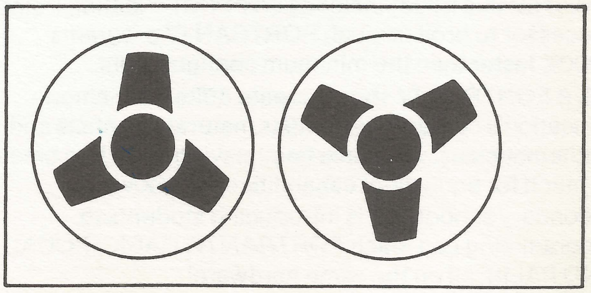
What can we do to correct some of these difficulties?

1. We must create a strong public voice to change our social equation to something like:

   Basic education + appropriate skill development + individual effort = probable success.
2. Strong teacher training programs must be developed for tomorrow's teachers.
3. Student counselling must improve. Counsellors must become aware that the tradespeople and craftsmen they deal with daily are the honorable backbone of our nation and not imports from another planet.
4. We must review and change our curriculum patterns.
5. Communication paths must be established between administrators and classroom teachers, between students, and between educators and the general public, including the users of our products—our graduates.

In conclusion, we have a national educational system that is accomplishing more than has ever been accomplished. The system is plagued with significant problems which must be recognized and solved. In this country 30% of our entire population is directly involved in education as students, teachers, and administrators. Surely with these numbers of thinking people involved, we can find solutions and develop a truly utopian educational system.

About The Author: Mr. Heiserman was instrumental during the late 1960's in the development of the initial concept of career education. He subsequently developed the curriculum guide for career education for the U.S. Office of Education and is currently the director of the Massachusetts Radio and Electronics Institute, Boston, MA. This article is adapted from a paper by the same title, presented by the author to the Minnesota Vocational Association in 1972.



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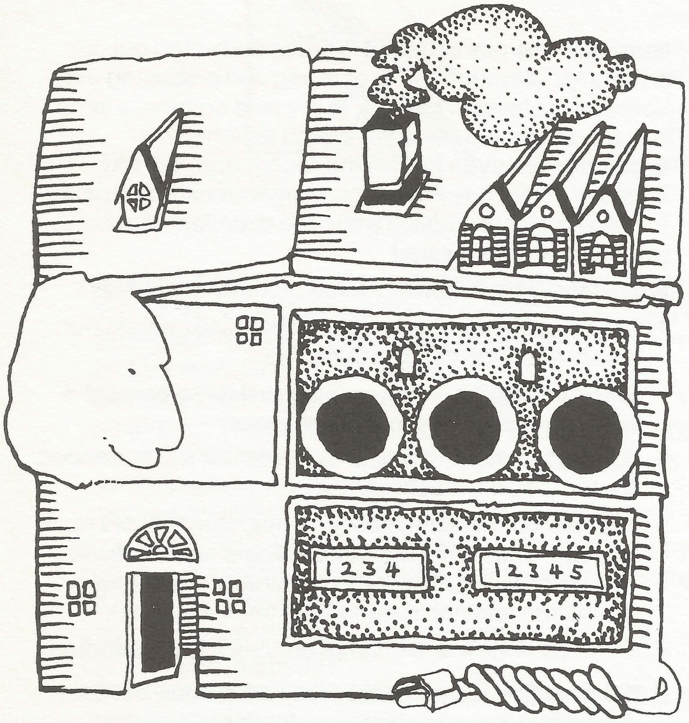
*Cahn, Gordon L., *The Education and Training of Marine Technicians,* American Association of Junior Colleges, 1968

PRODUCTS AND NEWS



FORTRAN IV.....$15,100

BUT NOT PER MONTH—NOT EVEN PER YEAR!

No, your eyes are not playing tricks on you. $15,100 is the *total* price of an *extended* ANSI Standard FORTRAN IV computer system—the lowest price available anywhere! Just introduced by DIGITAL, OS/8 FORTRAN IV is designed to operate on any current PDP-8 with a minimum of 8K core memory and mass storage.

As if they were not satisfied with their record-breaking price, the designers of OS/8 FORTRAN IV built a multi-speed capability into the system. The minimum hardware package consists of a standard PDP-8 family processor, DECtape and a terminal. A higher level system includes a KE8-E ExtendedArithmetic Element to increase speed 40%. The fastest system (see article on the FORTRAN ENGINE, this issue) includes an FPP-12 Floating Point Processor to broil through FORTRAN IV programs 2000% faster than the minimum configuration!

OS/8 FORTRAN IV should create quite a stir among education's computer scientists, natural scientists and mathematicians, who have been paying up to five times as much for equivalent capabilities. And now the secondary school that is introducing students to programming can teach *FORTRAN IV*, BASIC, FOCAL AND PALIII, all on the same hardware!

EDUSYSTEMS 20 and 25 REVISED

EduSystem 20

The newest version of EduSystem 20 is now available! In addition to all the nice features of the existing version like:

- One to eight user Dartmouth Standard BASIC and nine special functions
- Programmable mode operation
- Calculator (Immediate) mode operation
- Variable core partitioning
- Multiple statements per line
- Extended IF-THEN statement
- Special print formatting function
- Special Edit features
- Simplified error diagnostics,

the NEW EduSystem 20 has ALPHANUMERIC STRING PROCESSING! This feature is just like EduSystem 25's capability. Six character string variables can be input, manipulated and output; string arrays are supported; entire lines of string data can be input!

EduSystem 25

EduSystem 25 has been revised. All known patches have been added! And this new version supports eight users, too! All features mentioned above, plus DECtape or disk program and data file storage, and program chaining are supported!

If you're a registered user of EduSystem 20 or 25 software, update kits can be obtained for $50 (covers cost of material, packing, shipping, etc.).

Order Version C, No. QFE20 or Version B, No. QFE25-SC from the Software Distribution Center, Bldg. 1-2.

One of the most exciting capabilities of an OS/8 FORTRAN IV system is that it can run in a true batch mode. Thus, students can punch their FORTRAN IV, BASIC or PAL programs on cards and run them under OS/8's BATCH system. Programs in various languages can be intermingled in a single batch stream.

OS/8 FORTRAN IV utilizes a powerful overlay system allowing large programs to run in very small memories. For example, COGO-8, an application program for coordinate geometry, employs about 200,000 machine instructions and runs in a 16K word PDP-8 with OS/8 FORTRAN IV.

For more information on OS/8 and the new FORTRAN IV, write DIGITAL or ask your Educational Specialist for the brochure entitled "OS/8."

EDUTECH – A BETTER WAY

It is now possible for a vocational-technical school to present to its students the same computer technology coursework that has been developed by a major computer manufacturer and used to train its own personnel and customers. EduTech, DIGITAL's new EduSystem, is the first computer system package with the ability to teach "hands on" computer technology.

Computer science and computer technology courses in vocational-technical schools, as well as junior colleges and universities, often consist of an introduction to the functions performed by the basic components of digital computers. Illustrations of how these functions are implemented are often presented through the use of logic trainers, such as DIGITAL's computer lab. But there are recognized limitations in this type of approach. The primary drawback is that the student does not obtain "hands on" experience with a typical computer system and all of its options and peripherals.

EduTech is the preferred "hands on" approach to computer technology—the same approach used by full-time computer hardware instructors at DIGITAL's nine Education Centers throughout the world. EduTech systems have the full range of comprehensive computer technology coursework, beginning with instructional coverage of the basic computer processor and Teletype I/O architecture.

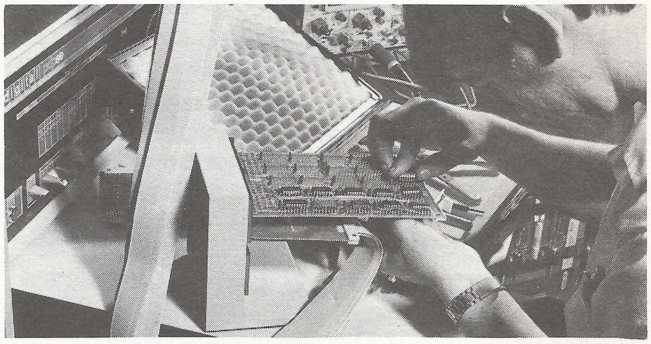
The smaller starter systems can be gradually expanded as your curriculum and budget dictate. They can grow to include total instructional packages covering computer options and peripherals such as mass storage devices (disk files, magnetic tape systems, cassette tape systems), paper tape reader and punches, card readers, display devices (alphanumeric and graphic displays, point plot displays), hard copy devices (line printers, incremental plotters), laboratory devices (A/D-D/A converters) and CRT and data entry terminals. An additional option, the "Experiments in Logic Design and Computer Interfacing" curriculum package, covers practical laboratory experiments in computer interfacing and control.

Learning Through Experience

EduTech systems reflect the most common "state of the art" computer architecture in use today. They have been extensively tested and debugged in the classroom. EduTech systems are understandable, yet challenging at all levels of learning. They have proven to be a highly effective way to gain active student interest and participation in class discussions. And by using short demonstration programs in machine or assembly language the teacher is able to guide intuitive thinking. In follow-up laboratory exercises, students can develop concepts which grow directly out of their understanding of the principles involved. At the same time, EduTech systems simplify the difficult task of explaining the abstract concepts and processes involved in computer design, programming, logical functions, circuit analysis or maintenance fundamentals.

"Hands on" learning with a real computer gives students that vital firsthand knowledge of its workings. By developing programs in machine, assembler and compiler languages, students come to understand that their own thinking processes can be adapted to the organization of the computer. And they begin to identify grouping of data.

Teachers can use EduTech systems to demonstrate the contents of each register by showing register interrelationships. In this way the student can see information being stored, retrieved, controlled and modified as the computer performs the required logical, arithmetic and data processing operations. EduTech systems illustrate such concepts as counting, shifting, decoding, timing, interface control and memory organization. Circuit principles learned in basic digital logic are readily converted to systems applications and are reinforced by using EduTech systems.



Course Materials

EduTech course materials are specially designed to provide an integrated technical course in computer science or technology. Course content can be tailored to different educational levels, from high school programs to university level engineering programs. The instructor can follow the course material as presented in the instructor's guide or he can adjust it to emphasize specific subject matter, grade levels or rates of instruction. This can be done by deleting certain sections or by adding supplementary material, such as DIGITAL's instructional packages covering such topics as computer interfacing, options and peripherals.

The following are the seven sections of instruction in the basic course. Additional, specific instructional packages have been prepared and can be added to this foundation material:

I. Computer Fundamentals
II. Elementary Programming Techniques
III. Computer System Introduction
IV. Computer System Analysis
V. Computer Maintenance
VI. Computer System—Internal Interfacing
VII. Computer System—External Interfacing

For more information, request a copy of the EduTech Brochure from: Communication Services, Digital Equipment Corporation, Maynard, MA 01754.

DARTMOUTH ANNOUNCES PLANS FOR PDP-9

Dartmouth's Software Development Project, headquartered at Kiewit Computation Center, recently announced its plan to provide generalized systems software support for the school's PDP-9. Researchers and other users with specialized projects will be expected to develop their own applications programs.

Dartmouth's PDP-9 is used for several purposes: experimenting with a simple time-sharing system, exploring techniques of interconnecting a small and a large computer, and teaching other "hands on" programming. It is equipped with a cathode-ray screen and is therefore particularly suitable for developing plotting routines.

EDUCATIONAL LIBRARY CATALOG

DECUS has just published a new Catalog of BASIC educational programs that contains a wealth of programs for the PDP-8 and PDP-11 Educational Systems. Many new programs have been added to the existing collection in Mathematics, Science, Computer Science, Administration, Social Studies, etc.! The Catalog and program documentation is free to all members of DECUS. Write today for your copy to the DECUS Librarian, Bldg. 3-4.

THE FORTRAN ENGINE!

(A NEW KIND OF EDUCATIONAL COMPUTER SYSTEM)

Everyone knows about EduSystems, right? How they use BASIC, the universally accepted educational computer language? How they are the lowest cost and most reliable systems for general classroom and computation center use? How they sport multi-user capabilities and emphasize ease of use? Right?

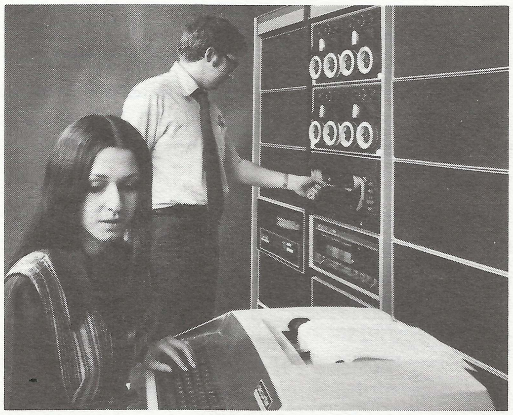
WRONG. Because now Digital has an entirely NEW kind of educational computer system. It's called the FORTRAN ENGINE. It's a "NUMBER CRUNCHER," because it munches massive mounds of data, spits out results and asks for more. It's the Superman of educational computers. It uses full ANSI Standard FORTRAN IV, the universally accepted scientific computer language. It's the low cost, reliable computer system for COLLEGE & UNIVERSITY DEPARTMENTS—statistics, computer science, business mathematics, natural science and engineering departments. It's FAST—TWICE as fast as competitive systems costing FIVE times as much, and is designed primarily for single user DEDICATED applications.

The FORTRAN ENGINE consists of a 12K PDP-8/E computer with powerfail and automatic restarting, a double precision floating point processor, a 256 word read-only-memory allowing bootstrap loading from DECtape, a 1.6 million word cartridge disk system expandable to 6.4 million words, a single Omnibus DECtape and a DECwriter terminal.

It is expandable (any educational computer has to have expandability) to a batch system for long, frequently run production jobs and higher throughput, or to a multi-user system for introducing students to interactive computing.

We're excited about our new number cruncher. So excited, in fact, that we have nicknamed it "EduCrunch" and dedicated a candy bar to its honor. Want one? See the article on "FREE EDUCRUNCH" in EDU#8.

What more could anyone ask for? Information. We've got that, too. So mail back the coupon and learn more about the FORTRAN ENGINE.



A typical FORTRAN ENGINE configuration.

Mail to: Educational Products Group, 5-5
Digital Equipment Corporation
Maynard, Massachusetts 01754

☐ Tell me more about the FORTRAN ENGINE!

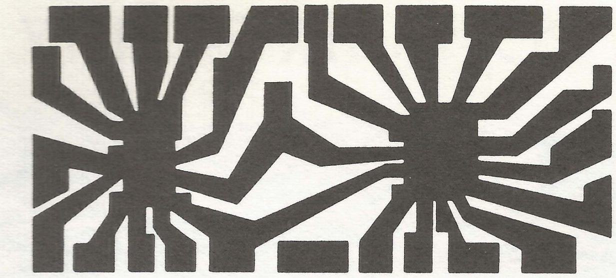
☐ Send me a FORTRAN ENGINE! Enclosed is my check for $37,085.

Name____________________Title________
School____________________Dept.________
Address____________________Telephone________
City__________State________Zip________

My need is ☐ immediate ☐ 6-12 month ☐ 1-3 years ☐ Info Only

Computer Usage Now
- ☐ On-site computer-Mfr. Model______
- ☐ Service Bureau
- ☐ Timesharing or RJE Terminal
- ☐ No computer—plan to get one
- ☐ No computer—no plans to get one

School
- ☐ Secondary
- ☐ Vocational-technical
- ☐ Comm./Jr. College
- ☐ Coll. or Univ. Comp. Ctr.
- ☐ Coll. or Univ. Dept.
- ☐ Other______



NEWS FOR GRAPHICS

TEKGRAPHICS is a quarterly publication of Tektronix, Inc. It deals with the latest information on software, hardware and customer applications for graphic computer terminals in a fresh and enlightening manner. The April 1973, Number 5 Issue of *TEKGRAPHICS* featured educational applications of graphics terminals. The articles are informative, well-written accounts of customer applications in CAI, physics and business simulations, gaming, medical diagnosis, training of the handicapped and bus scheduling. Lawrence Mayhew, Division Manager, supports the educational customer application approach of the issue by stating in his introduction, "...we think their stories have very interesting plots (if you'll excuse the pun)."

To obtain your own copy of *TEKGRAPHICS* write to:
Tektronix, Inc., Information Display Products Division,
P.O. Box 500, Beaverton, Oregon 97005.

Tell them EDU sent you.

HUNTINGTON ORDERS

A brand new Huntington II Project Materials Brochure is hot off the press! It describes the Huntington Project and the simulation materials and outlines pricing and order procedures.

The following program modules are now available for purchase:

Biology:

GENE1:	Simulates the inheritance of genetic traits.
LOCKEY:	Studies the lock and key model of enzyme action.
MALAR:	Students control malaria epidemic.
POLUT:	Simulates the pollution of a lake, river or pond from various types of waste.
POP:	Model of gypsy moth population growth.
STERL:	Investigates the effectiveness of insect control by means of male sterilization and pesticides.

Physics:

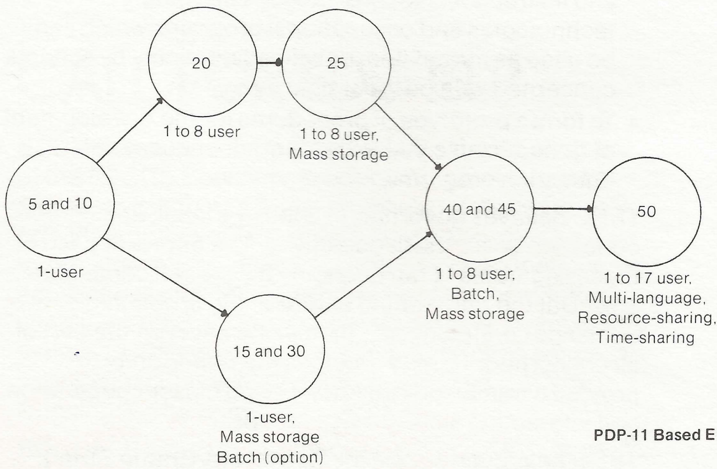
CHARGE:	Determines electron charge by simulating Millikan's oil-drop experiment.
SLITS:	Young's double slit experiment, showing light interference patterns.

Social Studies:

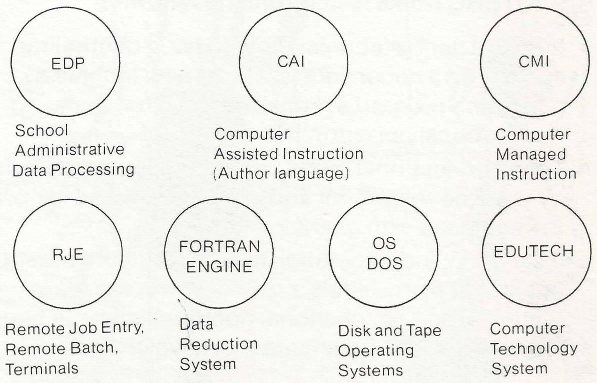
MARKET:	Game engaging two companies in one-product competition.
POLICY:	As members of various pressure groups, students formulate national policy.
POLSYS:	As various community members, students influence city government policy.

To obtain your Huntington II Brochure and order form write to Communication Services today!

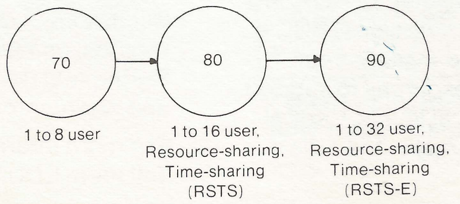
PDP-8 Based EduSystems



Other PDP-8 and PDP-11 Based Educational Systems



PDP-11 Based EduSystems

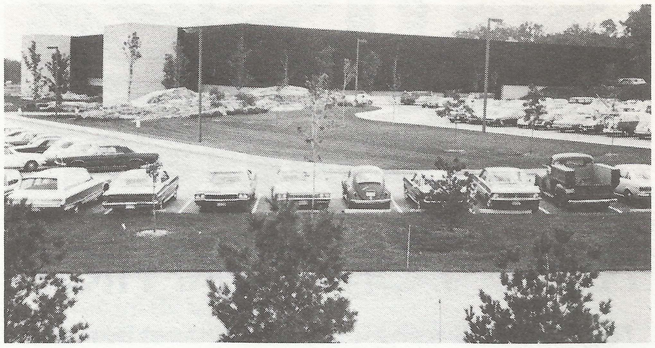


DIGITAL PURCHASES RCA COMPUTER FACILITY

On July 18, 1973, Digital Equipment Corporation agreed in principle with RCA Corporation for the purchase of RCA's Marlboro, Massachusetts facility. This agreement is subject to RCA and DIGITAL obtaining the approval of their respective boards of directors.

The facility, located approximately 20 miles from DIGITAL's headquarters in Maynard, consists of 173 acres of land and approximately 700,000 square feet of modern manufacturing and administrative space.

DIGITAL intends to use the property as an extension of its existing facilities. Corporate headquarters will remain in Maynard.


New DIGITAL facility in Marlboro, MA.

TECHNICAL EDUCATION RESEARCH CENTER, INC.

Technical Education Research Center, Inc. (TERC) is an independent, nonprofit, public-service corporation dedicated to the improvement of occupational and technical education throughout the United States. It was founded in 1965 by a group of leading technical educators in the belief that many of the highest priority problems in occupational and technical education require interdisciplinary research which brings together the ideas and talents of educators, social scientists, and industrial and professional specialists throughout the country.

In addition to carrying out needed research and development programs, TERC assists educational planners, administrators, and others in developing national, regional, state, and local programs in occupational and technical education.

In establishing TERC, the founders recognized that our society is increasingly technological and that technologies are themselves proliferating and changing with accelerating rapidity. Of the many problems that result, TERC seeks to confront the following:

- Industry needs technicians who have continuing access, on a nationwide scale, to new technical education programs preparing them for changing occupational opportunities.
- These educational programs should be characterized by rapid development and periodic revision in order to keep pace with changing needs.
- Education, industry, labor, and government must interact at many levels and in new ways to meet technical and occupational needs which have been identified and to anticipate those which have not.

TERC views its role as a catalyst in fostering these interactions. As an independent agency that is not itself educational, commercial, or governmental, TERC is in a unique position to fulfill this particular mission. TERC's centralized information, planning, and management systems will help mobilize national resources to support projects at the state, regional, and local levels. Central program analysis and evaluation can make one area's experience relevant to another's.

TERC works closely with educators, schools, professional societies, industry, labor, and governmental agencies throughout the United States.

TERC is currently operating research-and-development programs funded through various federal agencies. In addition to federal funding, financial support is provided through grants and contracts from foundations, educational institutions, and industry. The ultimate objectives of the research-and-development programs operated by TERC are:

- To help alleviate underemployment and unemployment problems associated with changing manpower requirements by developing occupational and technical education programs which are sensitive to national manpower needs.
- To contribute significantly to the development of new career opportunities for youth and adults, including educationally disadvantaged and occupationally displaced persons.
- To develop courses of study, textbooks, training aids, and instructional techniques for emerging technologies and occupational programs which can be used as formulated, or with adaptations, by schools concerned with occupational education.
- To form a prototype of procedures for the development of generalizable curricula for other occupational education programs.

TERC believes government, industry, labor, and education share these objectives. The efforts of each of these segments of the economy have been commendable. But the burgeoning nature of the problems demands continuing and increasing effort on the part of all concerned. TERC welcomes the opportunity to provide a framework which will bring closer cooperation and interaction among these groups.

TERC headquarters are located at 44A Brattle Street, Cambridge, Massachusetts 02138. TERC also has regional offices in Atlanta, Los Angeles, Milwaukee, Springfield (MA), Urbana (IL), Stillwater (OK), Waco (TX) and Washington, D.C.

For more information, contact the office closest to you. Tell them EDU sent you!

A SMALL MEMORY YIELDS A LARGE ONE

A PDP-8 with 12K and no mass storage increases students' capability to remember whatever they want!

To the first year medical school student, it is absolutely essential to remember the symptoms and immediate action for any number of maladies. The language student finds his fluency improves only after a rigorous vocabulary drill. The third grader needs to know the multiplication tables. And the computer programmer can do his job faster and more efficiently if he is intimately familiar with the computer code.

All these scholars and, in fact, scholars from nearly every discipline need to remember the basic facts on which their course of study is built. DRILL can help.

The DRILL program, developed by Dr. Francis Wheeler from Beloit College in Wisconsin, permits the user to enter a series of two-part items. The first part is a cue; the second is the appropriate response to the cue. For example, the series for the chemistry student learning the chemical symbols for elements might be:

Sodium / Na
Potassium / K
Lithium / Li
Magnesium / Mg
Calcium / Ca

Each cue item is then presented repeatedly until the user has demonstrated that he can remember the appropriate response quickly, accurately and consistently. The order of presentation is determined by a large number of factors, including promptness of response, the history of the user's reaction to the item thus far in the drill, and a "confidence factor" which measures how certain the user is of his response.

The printout of randomized comments of encouragement, randomized use of the learner's name, special recognition of "problem" items (as revealed by the learner's performance), and constant indications of progress on a relative scale combine to give the drill experience a gamelike quality.

In its design, the program takes advantage of several fundamental elements in the psychology of learning.

These include the liberal use of positive reinforcement, a judiciously limited use of negative reinforcement, and attention to the general character of memory decay, including the effect of interference. Ideally the learner encounters each item again somewhere near the point where he is likely to forget it because of interference by intervening items and other natural factors. This "forgetting threshold" is presumably dependent on the individual learner and the particular item and circumstances. The program uses an empirical formula that makes a unique prediction for each item on each occasion. Thus the resulting learning experience can truly be called "individualized" even though the program is completely general and totally independent of the semantic link between any particular cue and its response.

DRILL is exactly what it purports to be: drill. It is not an evaluation of the learner and no provision is made for alternate answers. DRILL is designed to help the person who has a need to keep specific materials at the point of ready recall.

DRILL is written in PDP-8 assembly language. It is core efficient and operates most effectively on a PDP-8 with 12K of core memory. No mass storage or peripherals other than a terminal are needed. While a teletype is serving well at Beloit College, Dr. Wheeler suggests that a VT05 would be optimal.

DRILL will be available in December from the DECUS library. Dr. Wheeler eagerly solicits the comments and reactions of all who use the program. Please send them to F. M. Wheeler, The LEARN Project, Beloit College, Beloit, Wisconsin, 53511.

HICKOK TEACHING SYSTEMS

Hickok Teaching Systems, Inc., is an organization that is uniquely qualified to provide a broad line of teaching materials and equipment to schools offering career education. A large percentage of these teaching materials are authored by qualified instructors presently teaching in technical institutions. They are then tested and in some cases improved by the curriculum development team at Hickok. Finally, the materials are evaluated by teachers and students at Hickok's wholly owned technical institute in Boston. This school, besides its role as an eminent private vocational school in the New England area, is employed in constant review and improvement of Hickok Teaching materials. With its 25 education sales specialists throughout the United States, Hickok provides instructional software and hardware planning expertise for their products and Digital EduSystems to the two-year Vocational-Technical school market.

For more information regarding a local contact write to:

Mr. Schuyler Taylor, Vice President
Hickok Teaching Systems, Inc.
Wheeling Avenue
Woburn, MA 01801

Mention EDU!

EDUSYSTEM HANDBOOK ADDENDUM

If you haven't already sent for one, be sure to obtain a copy of the latest EduSystem Handbook Addendum (July 1973). It contains updates to the technical documentation as well as descriptions of the recent systems enhancements. Order (No. DEC-08-EDHBA-B-DN1) from the Software Distribution Center, Bldg. 1-2.

POTPOURRI (Articles, Reports and Activities)

COMPUTERLAND FOR TIME TRAVELERS

"Computerland for Time Travelers" was the theme of a four-day computer fair held September 20-23, 1973, at the University of California campus at Berkeley. Sponsored by UC Extension in cooperation with the Lawrence Hall of Science, the fair was held at LHS for teachers, students and the general public.

The "time" traveled was the future—when computers will play as familiar a role in everyday life as the telephone and the automobile do today. Emphasis was given to "hands-on" displays, and Bay Area students participated in demonstrations that allowed visitors to operate computers and become acquainted with their functions and potential.

The fair included a large variety of computers (including two PDP-8 based EduSystems!) and an extensive collection of computer games, films, demonstrations, mini-seminars and workshops devoted to learning games and activities for the classroom. In conjunction with the fair, UC Extension offered a credit course that focused on the use of the computer as an educational resource.

The course instructors, all active in computer instruction, were Robert Albrecht, Jerald Brown, Peter Sessions, and LeRoy Finkel of the People's Computer Company, Menlo Park.

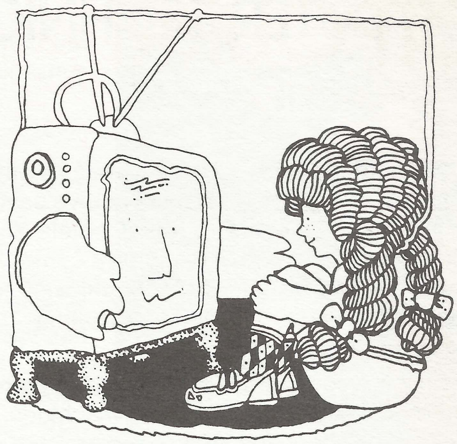
THE LAWS OF PROGRAMMING

Definition:	A "working" program is one that has only unobserved bugs.
LAW I:	Every non-trivial program has at least one bug.
	Corollary I: A sufficient condition for program triviality is that it have no bugs.
	Corollary II: At least one bug will be observed after the author leaves the organization.
LAW II:	The subtlest bugs cause the greatest damage or problems.
	Corollary I: A subtle bug will modify storage, thereby masquerading as some other problem.
LAW III:	Bugs will appear in one part of a working program when another "unrelated" part is modified.
LAW IV:	("Lulled into Security Law"): A "debugged" program that crashes will wipe out source files on storage devices when there is the least available back-up.
LAW V:	A hardware failure will cause system software to crash, and the CE will blame the programmers.
LAW VI:	A system software crash will cause hardware to act strangely, and the programmers will blame the CE.
LAW VII:	The documented interfaces between standard software modules will have undocumented quirks.
LAW VIII:	The probability of a hardware failure disappearing is inversely proportional to the distance between the computer and the CE.
LAW IX:	Murphy designed OS/360 (or your computer's operating system).
LAW X:	(O'Shea's Law): Murphy was an optimist.

Submitted to DECUS by David Kristol, student at Harvard University.

DIGITAL IN THE NEWS

Over the summer we've turned from the tube and transistor to the written media! As the leading manufacturer of minicomputers and as an experienced leader in the field of educational computing, DIGITAL has received a lot of coverage in major magazines lately!



August 1973	EDUCATIONAL TECHNOLOGY Cover Story "Grand Forks Computer: Seeking the Individual" by Walter H. Knipe. Mr. Knipe is the Computer Projects Director for the Grand Forks Schools in Grand Forks, N.D. His article describes the many applications, from CAI to Resource Management, of the district's EduSystem 50 (TSS/12).
June 1973	SCHOOL SHOP "A Computer System For Students Only" by Vincent Fazio. Mr. Fazio is a teacher/coordinator at Edison Technical and Industrial High School in Rochester, New York. His article describes the use of an EduSystem 50 (TSS/8) Computer System in Edison's comprehensive Vocational/Technical education program. (See article in this issue)
June 1973	SCHOOL PRODUCT NEWS "Computer Simplifies Administration." This article deals with the use of DIGITAL's EduSystem EDP at Melrose High School, Melrose, MA.
May 24, 1973	ELECTRONIC DESIGN 11 "Portrait of a Minicomputer Mastermind: Gordon Bell, Engineer in a Big Hurry.". The story of C. Gordon Bell, father of the minicomputer and DIGITAL's V.P. of Engineering.
May 1973	THE MATHEMATICS TEACHER "Administrative Data Processing" (P. 439). This article describes the software and hardware components of EduSystem EDP.
March 1973	THE MATHEMATICS TEACHER "The Timesharing-Terminal Eliminator" (P. 248). A descriptive analysis that deals with the EduSystem 15 instructional computer system.

SIMULATION SEMINARS

The Huntington II Project Staff is now sponsoring on-site seminars for secondary schools and junior and community colleges. These seminars include instruction on the use of computer simulations as learning tools and deal specifically with the use of the Huntington II Simulation Materials.

Seminars vary in length from 1-5 days; two instructors from the Huntington Staff conduct the sessions in two major subject areas. Each attendee receives a complete set of the Huntington II Simulation Materials.

The cost of the Seminar is $150 per day. In addition, a school district must cover instructors' travel, lodging and meal expenses for the duration of the seminar.

For more information contact: Dr. Ludwig Braun, Huntington II Project, State University of New York, Stonybrook, New York.

Tell him EDU sent you!

SR EDUCATION

The May Issue of *Saturday Review of Education* is bound to be a collector's item for more than *one* reason.

First of all, it was the last issue of *SR Education* (we're very sorry to say).

Secondly, the magazine featured the topic of "Educational Technology." The issue contained many good articles on computers in education: Suppes vs. Albrecht (a confrontation of the Stanford CAI giant and the PCC game-lover), General Turtle, Electronic U (Golden West C.C., Huntington Beach, CA.), and a half dozen editorials and short commentaries on the future of technology in education.

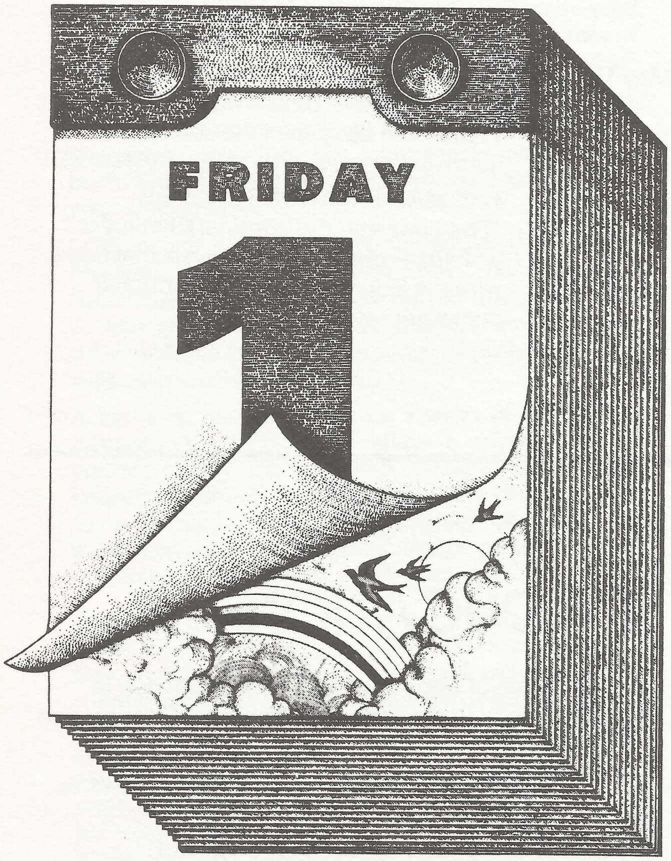
A definite *must* for your personal or school resource collection. Obtain a copy (if you can) from: *Saturday Review*, 450 Pacific Avenue, San Francisco, CA 94133.

COMPUTER TECHNICIANS-THREE NEW JOBS A DAY

—by Dixie Sommers

Computer systems play a vital role in today's way of life. They help us make telephone calls, receive paychecks on time, and reserve tickets for travel, hotels, and entertainment. In business and industry, computer systems perform a wide variety of complicated tasks—from keeping business records to controlling manufacturing processes.

Exactly what is a computer system? It is the combination of a computer, plus computer-related machines, such as magnetic tape readers and high speed printers. The basic computer is a complex "electronic brain" containing miles of wires and thousands of tiny electronic parts. Keeping this intricate battery of machines in good working order is the job of highly-qualified computer service technicians.



At regular intervals, a technician (sometimes called a field engineer or customer engineer) services machines or systems to keep them operating efficiently. He routinely adjusts, oils, and cleans mechanical and electro-mechanical parts. He also checks electronic equipment for loose connections and defective components or circuits.

Despite this regular care, however, computer equipment sometimes breaks down. The technician must then find the cause of the failure and make necessary repairs. For example, he may replace a faulty circuit board, resolder a broken connection, or repair a mechanical part. He must complete the job as quickly as possible, because working time lost during a computer breakdown may cost a customer several hundred or even thousands of dollars an hour.

The computer technician often helps install new equipment. In doing so, he lays cables, hooks up electrical connections between machines, thoroughly tests the new equipment, and corrects any problems before the customer uses the machine.

Some technicians specialize in maintaining a particular computer model or system, or in doing a certain type of repair. For example, a technician may become an expert in correcting problems caused by errors in the computer's internal programming. Specialists usually have advanced training and several years of experience.

His Tools

To diagnose electronic failures he must use several kinds of test equipment, including voltmeters, ohmmeters, and oscilloscopes. He also runs special computer programs which help him pinpoint some kinds of malfunctions. The technician also uses a variety of handtools such as needle-nosed pliers, wirestrippers, and soldering equipment. Though tools and test equipment are supplied by the employer, the technician may be responsible for keeping them in working order.

Besides knowing how to use specialized tools and test equipment, the computer technician must be familiar with technical and repair manuals for each piece of equipment. He must keep up, too, with the technical information and revised maintenance procedures issued periodically by computer manufacturers.

The technician does a large amount of paper work. This includes keeping a record of preventive maintenance and the repairs made on each machine he services. In addition, he fills out time and expense reports, keeps parts inventories, and orders parts.

Although the technician spends most of his time working on machines, he works with people, also. He listens to the customer's complaints, answers questions, and sometimes offers technical advice on ways to keep equipment in good condition. Experienced technicians help train new technicians, and sometimes have supervisory duties.

Where the Jobs Are

In 1971, 30,000 computer technicians were employed in the United States. Nearly all of them worked in the service departments of computer manufacturing firms. A small additional number worked for companies which sell computer maintenance services and for the Federal Government and other organizations which have large computer installations. A few women work in this occupation.

Computer technicians work in all parts of the country, usually in urban areas where most computer equipment is located. Some technicians work full-time at a single installation, such as a large computer center operated by a bank or insurance company. Others travel from place to place to maintain several different systems or to make emergency repairs. A technician with special training or experience may travel hundreds of miles from his home office to handle difficult repair jobs. A technician working for a nationwide organization must sometimes transfer to another city or state.

Qualifications

A high school student interested in becoming a computer service technician should take courses in mathematics and physics. Courses in electronics and computer programming offered by some high schools also are helpful. Young people can also gain valuable experience through hobbies which involve electronics, such as building ham radios or stereo equipment.

Most employers require applicants for technician trainee jobs to have 1 to 2 years' post-high school training in basic electronics or electrical engineering. This training may be from a computer school, a technical institute, a college, or a junior college. Basic electronics training offered by the Armed Forces is excellent preparation for technician trainees.

Besides having some technical training, applicants for trainee jobs must meet certain physical and personal qualifications. They need good close vision and normal color perception to work with small parts and color-coded wiring. Normal hearing is needed as well, since some breakdowns are diagnosed by sound. Because technicians usually handle jobs alone, they must have the initiative to work without close supervision. Also important are a pleasant personality and neat appearance, since the work involves frequent contact with customers. Applicants must pass a physical examination and, in some cases, get a security clearance.

Advancement

Several paths for advancement are open to experienced technicians. Those with considerable technical ability and advanced training may become technical specialists. These workers help technicians make their more difficult repairs and work with engineers in designing equipment and developing maintenance procedures. Those with leadership ability may supervise other technicians at large computer installations, or become service managers in the firm's regional offices.

Although advancement depends mainly on the technician's ability and experience, his chances are improved if he has a bachelor's degree in electrical engineering. Many servicemen get their degrees at company expense. Engineers interested in professional careers in computer service work often start out as technicians.

Most computer equipment operates on the same basic principles, but machines built by different companies may be unique in design and construction. For this reason, a technician may find it difficult to transfer from one company to another, particularly if he has specialized skills. Technicians who transfer may lose seniority, and usually need some retraining.

Outlook

Employment of computer technicians is expected to grow rapidly during the next 10 years, creating about a thousand new jobs annually. As the nation's economy expands, more computer equipment will be used and more technicians needed to install and maintain it. Business, government, and other organizations will buy or lease additional equipment to manage vast amounts of information, control manufacturing processes, and aid in scientific research. The development of new uses for computers will also spur demand.

Although most job openings will result from employment growth, many will occur also as experienced technicians advance to more responsible jobs or move into other occupations.

Salaries

Starting salaries for computer technician trainees ranged from $126 to $145 a week in 1971, based on the limited information available. Salaries for experienced technicians ranged from $205 to $305 a week.

The normal workweek is 40 hours, but technicians often work overtime and on weekends to make emergency repairs. Many technicians work rotating shifts—days one week, nights the next.

General information on careers in computer maintenance is available from:

American Federation of Information Processing Societies, Inc.
210 Summit Ave.
Montvale, N.J. 07645
Institute of Electrical and Electronic Engineers
345 East 47th St.
New York, N.Y. 10017

The personnel and service departments of computer manufacturers and other firms employing computer technicians can provide details on training and job opportunities.

The state department of education at each state's capital can furnish information about approved technical institutes, junior colleges, and other institutions offering post-high school training in basic electronics. Information about these schools is also available from:

American Association of Community and Junior Colleges
Suite 410
1 Dupont Circle
Washington, D.C. 20036

Reprinted from *Occupational Outlook Quarterly*, Fall 1972.

BOOK REVIEWS

BASIC, by Robert L. Albrecht, LeRoy Finkel, and Jerald R. Brown. John Wiley and Sons, Inc., New York, 1973, $3.95.

BASIC is the newest of the self-teaching, programmed instruction texts published by Wiley. Written by the people from DYMAX who brought the educational world such classics as *Teach Yourself BASIC* (Tecnica) and *Populution* (DIGITAL), *BASIC* offers classroom tested textual material to educators at the secondary level and above. The text is well developed and written; each chapter is terminated with a self-test for ease of evaluation.

This is an excellent volume which belongs in every classroom, regardless of computer application.

Physics and Computers, by Robert Ehrlich. Houghton Mifflin Co., Boston, MA, 1973.

Physics and Computers illustrates computer applications in physics at the beginning and intermediate undergraduate levels. It includes a wide variety of numerical methods, computer techniques and simulations of familiar laboratory experiments.

The book contains selected problems in electricity, waves and modern physics, as well as an introduction to computers, flowcharts and FORTRAN IV.

Ample documentation makes the programs relatively language and computer independent. A substantial number of problems from a wide range of difficulty levels are included in each chapter; the book is also cross-referenced to 24 of the most popular introductory physics texts to enhance its use as a supplementary text.

A Guide To Teaching About Computers in Secondary Schools, by Donald D. Spencer. Abacus Computer Corporation, Ormond Beach, Fla., 1973, $12.95.

This is an excellent, comprehensive handbook for teachers, administrators and curriculum specialists now using or planning to implement computers in the secondary curriculum. Designed to aid in the planning, content and methodology of instructional computer use at this level, Spencer's guide also contains lists of available classroom resources and materials.

Maurer, H. A., and Williams, M. R.
A Collection of Programming Problems and Techniques.
Prentice-Hall, Englewood Cliffs, N.J., 1972, 256 pp. paperback, $6.95.*

In the preface of this text, the authors state their intent to create a text with a comprehensive collection of programming problems that will supplement books on programming, programming languages, and programming techniques. Without question, their effort has more than met its goal.

The problems in this text are both numerous and varied. They range in difficulty from easy to very hard, and they present problems in number theory, gaming, I/O, character handling, and statistics, as well as the traditional introductory problems. These problems (and sometimes even their algorithms) are stated in English sentences, and the use of machine or programming languages has been purposely avoided. Consequently, the book possesses a certain universality and timelessness.

Instructors who teach programming courses or computer science courses or both will find this a handy, ready reference text. Unfortunately, the text may be limited to just that group since it is too rich (and possibly expensive) for the average student who will, most likely, never have time to solve more than a handful of its abundant problems.

R. H. Eckhouse, Jr., Amherst, Mass.

Walker, Terry M.
Introduction to Computer Science: An Interdisciplinary Approach. Allyn & Bacon Inc., Boston, Mass., 1972, 530 pp.*

This book is aimed at the college freshman level for students with minimum mathematical preparation. The focus is on problem solving methodology rather than details of any particular programming language. To emphasize this, algorithms are represented by flowcharts (specific programming language supplements keyed to the main text are available). The author also gives equal emphasis to solving nonnumeric (string data) problems and numeric problems.

The first eight chapters of the book are dedicated to a basic understanding of computer-feasible algorithms. The next eight chapters exercise the principles of the first part of the book in specific application areas. The book concludes with a chapter on the computer and society. An introduction to assembly language programming is given in an early chapter.

While the entire treatment is intentionally elementary, it is well thought out and written in an easily comprehensible style. The typography and text layout are excellent. This reviewer recommends this book as well worth trying as a text for a general one-semester introductory course for students in both the physical and the social sciences.

M. Klerer, Bronx, N.Y.

SMP Computing in Mathematics: Some Experimental Ideas for Teachers. Cambridge University Press, New York, 1972, 135 pp. $10.50.* (Available in paperback)

The School Mathematics Project (SMP) is based in the United Kingdom; since its inception in 1961 it has developed and published several series of textbooks for the various school levels in Great Britain. This book, the first volume in the series on computing in mathematics, establishes some guidelines that should be considered by teachers undertaking this curriculum. It deals with the elementary principles of computing and programming, shows how to introduce students to computing, and warns of the pitfalls usually encountered in performing calculations on a computer. Rather than a continuous text, the book is more a series of essays covering the main topics of computational mathematics. The topics on mathematics are preceded by chapters discussing the basic concepts of machine calculation, computers, and the elements of programming. The text is replete with examples and problems.

As a former high school mathematics teacher, the reviewer finds this to be an excellent introduction to mathematical computation for those high-school teachers knowing little about computing and wishing to develop a curriculum more in tune with today's needs and technology.

W. J. Holden, Sunnyvale, Calif.

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* Reprinted with permission from *Computing Reviews*, Association for Computing Machinery, 1972.

COMPUTERS AND THE LIBERAL ARTS

by Ronald R. Edwards

In the short span of thirty years, thousands of electronic computers have been placed in operation in the United States; yet there remains a computer shortage. We have no fear of Art Buchwald's prediction that we will run out of data to process by 1976—"...if our figures are correct, every last bit of data in the world will have been fed into a machine by Jan. 12, 1976, and an information famine will follow, which could spread across the world" (Washington Post, 1969). Nor must we accept the thesis that the proliferation of machines is but another example of Parkinson's law. The fact is that we are just beginning to learn how to use computers—in business, research, education, law, medicine, etc.

Yet, in this time of great expansion in numbers of machines and development of new applications, we continue to produce a citizenry which is both ignorant of and intimidated by the computer. It is difficult to understand how this can happen when computers have filtered from graduate schools, to undergraduate, to high schools, and into the elementary schools. Perhaps part of the problem lies in our approach to computer utilization in our schools and colleges. In our public schools the emphasis is most often on computer use by college bound students for problem solving or explorations by the most talented students. Often without clear-cut policies or priorities, computer centers in higher education serve the following functions (in an understood order of importance): data processing, faculty research, student research and problem solving in applied fields, computer science, programming courses, CAI, and (minimal to non-existant use) teacher education and liberal arts.

If one of our educational priorities is to produce a citizenry that is neither ignorant of nor intimidated by the computer, we must consider a wider base for introducing the computer in education. Mentioning in freshman mathematics that base two arithmetic has something to do with computers is not going to help. Merely having a computer available in the high school is not the answer either.

How might we introduce the general high school student or the Liberal Arts freshman to the computer? A good introduction might revolve around: (1) Man's view of the machine through literature (for example, Capek's *R.U.R.*, Marchant's *Desk Set,* or Clark's *2001: A Space Odyssey*), (2) the computer impact on man, business, law, medicine, etc....(articles in Taviss' *The Computer Impact,* Prentice-Hall), (3) an historical sketch of the computer (articles in Baer's *The Digital Villain*, Addison-Wesley), (4) a brief introduction to programming in the BASIC language, and (5) a good amount of interaction with calculators and a computer in a laboratory setting. These topics may be explored in a mathematics course (or in an inter-disciplinary course) together with such topics as: logic, a study of sets, elementary circuit theory, flow charting, problem solving, probability, and statistics.

Whatever the level of instruction (high school or college) the computer, its applications, and its impact on society has earned a place in the general studies and mathematics curricula. A meaningful study of the computer phenomenon can be developed for short course units or full semester courses. Such a course, Mathematics for Liberal Arts, is currently offered at Westfield State College, Westfield, Massachusetts. The computer laboratory aspect of the course was taught on Springfield Public Schools' RSTS-11 last academic year. For the coming year, the number of sections of this course has increased from one to five, and the computer laboratory work will be done on Westfield's new PDP-8.

About the author:
Dr. Edwards is an Assistant Professor of Mathematics at Westfield State College, Westfield, MA. He holds an AB degree from Brown University, MAT from Wesleyan University, and PhD from University of Connecticut. His computer interests include the integration of laboratory work into liberal arts courses and research with middle school students. Dr. Edwards is a guest editor of this issue of EDU.

MEETINGS OF INTEREST

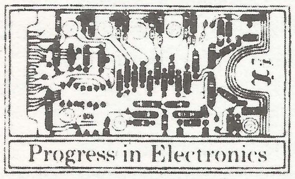
REGIONAL:

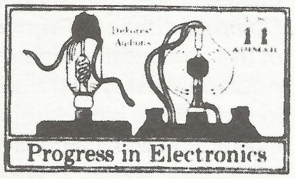
OCT. 4-6	NCTM, National Council of Teachers of Mathematics: Edmonton Meeting, Edmonton, Alberta; and Indianapolis Meeting, Indianapolis, Indiana.
OCT. 11-13	NSTA, National Science Teachers Association, Western Area Convention Exposition, Portland, Oregon.
OCT. 11-12	ATEA, American Technical Education Association, Central Regional Conference, Terre Haute Community College, Terre Haute, Indiana.
OCT. 12-13	ATEA, American Technical Education Association, Atlantic Regional Conference, Lehigh Community College, Schnecksville, Penna.
OCT. 25-27	NCTM, Atlanta Meeting, Atlanta, Georgia.
NOV. 2-4	NCTM, Toronto Meeting, Toronto, Ontario.
NOV. 8-10	NSTA, Southeast Area Convention and Exposition, Norfolk, Virginia.
NOV. 8-10	NCTM, Springfield Meeting, Springfield, Mass.
NOV. 8-10	National Association of Users of Computer Applications to Learning, Cincinnati, Ohio.
NOV. 29- DEC. 1	NSTA, Northeast Area Convention and Exposition, Boston, Mass.

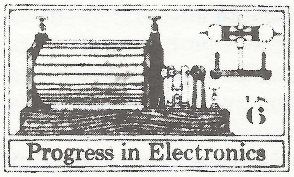
NATIONAL:

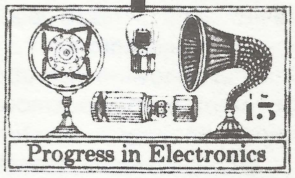
NOV. 30- DEC. 5	AVA, American Vocational Association, 67th Annual Convention and Show, Atlanta, Georgia.
FEB. 22-26	AASA, American Association of School Administrators, National Meeting, Atlantic City, N.J.
MAR. 15-19	NSTA, National Meeting, Chicago, Illinois.
MAR. 27-29	ATEA, American Technical Education Association, National Clinic, Columbia, S.C.
APR. 17-20	NCTM, National Meeting, Atlantic City, N.J.

Progress In Electronics Commemorative Stamps









These four stamps saluting Progress in Electronics perhaps mark the beginning of an era that may never end—for there is no end in sight for the developments burgeoning from the field of electronics. The spark coil, the Audion, the microphone, the radio speaker, were all extensions of this progress, until the transistor came not only to extend our thoughts and actions but radically to alter them.

An 8-cent stamp for first class mail commemorates transistors and illustrates a printed circuit board. A 6-cent stamp, intended for post cards, shows the spark coil and spark gap used by Marconi to send radio signals across the Atlantic in 1901.

An 11-cent airmail stamp shows DeForest's Audion and Audion tube. A 15-cent stamp, for international surface mail, shows an early microphone, a goosenecked speaker and a vacuum tube, combined with a TV camera tube.

How DEC Builds Reliability Into Minicomputers

In the last twelve months Digital Equipment Corporation shipped around 5,000 PDP-8 minicomputers. While increasing its volume, the price of the PDP-8 dropped from $18,000 in 1965 to a current level of $4,000.

Consider, also, that over the past five years DEC sales have grown a staggering average of $30 million a year, from $57 million in 1958 to $187 million for the year ended in July, 1972.

The amazing part is that during this enormous period of growth, the company's products have been operating generally with a high degree of reliability, often in strange industrial environments. Few electronic companies can boast such a record of growth, combined with product reliability.

The company started in a huge old mill building in Maynard and has been developing its floor space virtually every year. It presently manufactures a large portion of its products in a brand new plant in Westminster that measured 260,000 square feet when it was built in 1971 and doubled to 520,000 square feet in 1972.

What makes a review of the DEC manufacturing operation interesting is that it is not really so different from any other electronic manufacturing company, small or large; it's just bigger, and some of the procedures are more thorough.

The company produces commercial equipment, yet some military manufacturers would do well to build electronic equipment as carefully as DEC. Quality starts in design, but is maintained as a result of a tremendous amount of component selection and testing, followed by system check-out and test.

The PDP-8 line, representing the highest repetitive volume, may be considered typical.

The grueling course starts in incoming inspection, also referred to as the "incoming rejection department." All integrated circuits and semiconductors go through thermal and mechanical shock before being tested, and an average of about 5% are rejected.

Ingrid Campbell, a German-born, no-nonsense supervisor of incoming inspection and test, proudly displayed the morning's collection of rejected components, about equal to the output of a small semiconductor manufacturing plant.

One lot of 135,000 diodes tested produced 30,000 for stock and 105,000 for shipment back to the vendors. A thousand out of 5,000 high speed logic circuits were accepted; the rest were neatly packaged in plastic bags for shipment -- back. Reliability data are neatly kept in a components index book and reviewed regularly by engineering.

Components that do pass incoming inspection (about 95% do) go to a stock room where they are put together in kits for manufacturing into subassemblies, generally on printed circuit boards. Manufacturing is well mechanized -- but a few hundred or a few thousand circuit boards do not lend themselves to a high degree of automation.

The completed sub-assemblies are tested, stocked, and kitted again for assembly into complete sub-systems.

At this point, components flow in from all over the world -- logic panels and CPUs from Puerto Rico, cables and power supplies from Canada, peripheral equipment and cabinetry from Westfield, Mass. Some specialized components come from the old Maynard plant.

Computers are used extensively in the test procedures. A minicomputer is involved in module testing; a complex mother-daughter test system runs up to 18 daughter systems through a lengthy series of diagnostic tests.

Errors are printed out. After a problem is resolved, the unit is accepted only after eight hours of failure-free operation. A total of 48 hours of operational test is required. Thermal cycles ranging from 50 degrees F. to 130 degrees F. and shock and vibration tests are included in the test program which every unit must pass.

The final components are configured into systems to customers' specifications or shipped as an O.E.M. product and undergo final test.

The complete working system moves on -- but not yet to the shipping department. Instead, the system now goes to Systems Acceptance, operated by the Field Service department. The Field Service people effectively have the contract to service the machine in the field. It is up to them to accept the equipment as a working unit. They have their own management, separate from production and quality assurance. This, in effect, provides a system of checks and balances in which the customer probably benefits.

Once having passed Systems Acceptance, the equipment goes to a final touch-up area, is shined and polished like a new automobile, inspected for nicks and scratches, and lovingly wrapped in plastic. The final shipment of the system is usually by padded van, directly to the customer.

From beginning to end, people, machines, and computers watch over the production. The resulting consistency of product quality is impressive.

Reprinted from *Electronic Engineering Times*, December 18, 1972.

TECHNICAL EDUCATION-CAREERS UNLIMITED

This article, which deals with technical and career education, consists of excerpts from an address of the same name by Robert M. Worthington. The address was presented at the National Technical Education Clinic on March 15, 1972, at Fort Worth, Texas. Mr. Worthington is an Associate Commissioner of Adult, Vocational and Technical Education for the USOE.

Career Education Must Start with Children

Until half a century ago, before the impact of applied modern technology began to displace muscle power with machinery, children had contact with the world of work which permitted them to comprehend and understand most of the common occupations and to respect the persons who performed the work of the society.

In recent years however, children have been isolated from the world of work. Farm and home chores have almost disappeared, and even the work within the home has been changed to such a degree that there is little meaningful contact between a modern child and those who do the work and supply the services in today's complex society. Working parents and members of the family leave home to work, perform their duties, and return. Their children are seldom able to obtain any meaningful understanding of what they do because they have little opportunity to observe and to interpret the tasks performed or the satisfactions, disciplines and rewards of work.

Career education programs give great promise of reopening the world of work to children as an interesting, exciting, challenging and fascinating area of activities and adventures. It is an excellent means of motivating children to learn about reading, mathematics, science, etc., while simultaneously learning about the necessity for and the dignity and satisfactions of work well done.

Career Education Beyond the High School

Career education beyond the high school includes preparation required by an individual to enter employment, improvement of his knowledge or skills as they relate to his job, or preparation for a new one. It also includes the cultural and recreational knowledge necessary to cope with living in the post industrial society. Man cannot live by bread alone!

Career education, in the context and the relationship of preparation for the work today and in the future, has little relationship to past practice. The accumulated results of applied science and technology have radically changed the world of work during the last half of the twentieth century to require a more demanding educational preparation where the specialization needed must in large measure be learned by adults after high school.

With the unskilled worker displaced to a great extent, we as a nation are confronted with a unique educational problem never before experienced to the same degree by any society. Our social heritage and mores have been built on the concept that most of our population must work to support themselves and to lead satisfying and fulfilling lives. A person without a job and without the preparation to get one does not enjoy a very favorable status in most of this society. Without a job he cannot support himself and can neither respect himself nor others, nor the society in which he lives.

Kinds of Workers Prepared in Post School Education

Almost all professionals, most technicians and similar supportive specialists, and many skilled workers will continue into programs beyond high school before they enter the work force. Almost all of these workers will return to institutions beyond the high school for formal upgrading, updating, or additional preparation for their careers in order to cope with changes in technology which affect their chosen occupations.

Technicians and Supportive Personnel

Technicians and similarly specialized supportive persons are the most needed personnel in today's world of work.

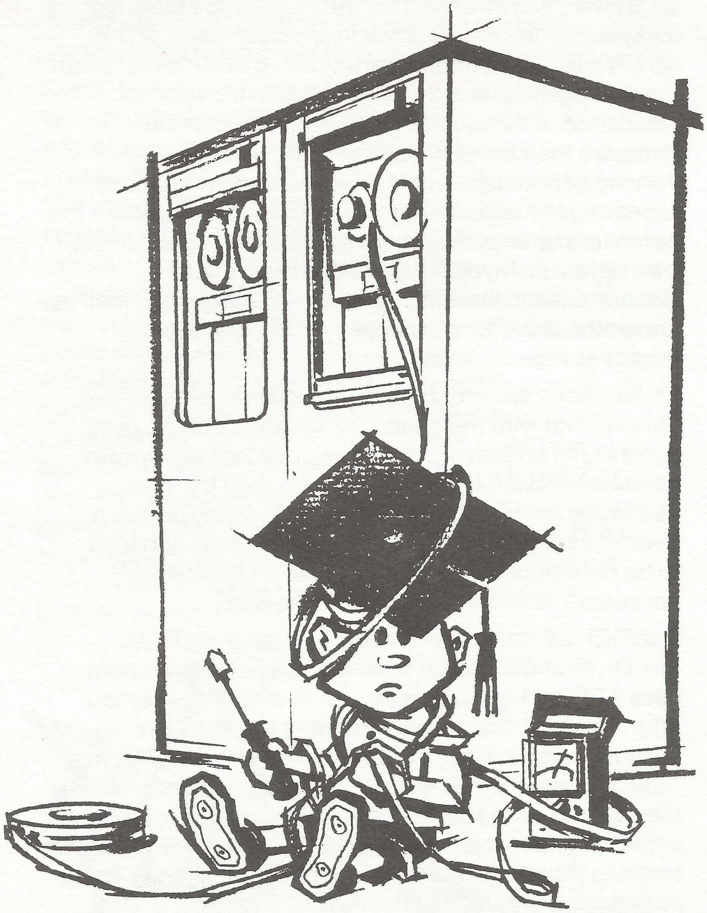
Their education requires a comprehension of the basic principles and technological knowledge of the professional whose efforts they support. In addition, they frequently learn managerial and administrative skills which permit them to direct the efforts of the skilled and semi-skilled workers whose efforts are required to accomplish the tasks in their field. Usually, however, administrative skills are learned after the person is employed.

Adult Education Beyond the High School (A Great Challenge)

A major career education emphasis beyond the high school must be to provide opportunity and encouragement to more adults. For example, it will help them upgrade their skills and knowledge on their present jobs, learn new skills and knowledge to change or advance their careers, retrain for new jobs when their present jobs have been eliminated by organizational or technological changes, and provide saleable skills to those who have never been in the work force.

Career education also provides specialized educational services for: women who have already raised families or who must supplement family income or provide all of it; older workers at all levels displaced by younger, better-prepared workers; retired military or other persons who want to enter another field of employment; and scientists, managers, and other professional leaders who have been displaced by such national technological goal changes as aerospace to environmental improvement.

The increasing necessity for our nation to provide educational opportunities for those who have left school and are unemployed, or those who are under-employed, is becoming increasingly evident. Clearly these persons, many of whom are mature, able, and talented but are perhaps handicapped by academic, socio-economic, or other circumstances, represent a valuable pool of human resources which must be developed. This is a major challenge to our postsecondary technical education programs.



Public Junior Colleges, Technical Institutes and Area Vocational Technical Schools

The fastest growing segments of the post-secondary, non-bacclaureate career educational establishment are the junior and community colleges, public technical institutes, and area vocational and technical schools. These schools receive most of the Federal, state and local financial support for occupational education below the baccalaureate level. They have the advantage of being able to respond to the needs of the geographic areas which support them.

The involvement of four-year colleges and universities in post-high school non-baccalaureate career education appears to be growing in response to national needs.

Private Schools and Colleges: Their Importance

Private educational institutions for occupational education beyond the high school comprise a very important part of post-secondary education. There are more private technical institutes, colleges, business schools and specialized trade and technical schools than public institutions which offer less than baccalaureate occupational education programs. The U.S. Office of Education lists about 7,500 accredited institutions under the federally supported student loan programs. Of this number there are about 2,500 public junior colleges, technical institutes, four-year colleges and universities and area vocational schools which offer technical education programs.

In addition to the accredited private institutions there is evidence that there are probably as many as 10,000 private schools offering specialized occupational programs. Many do not seek accreditation for purposes of student loans but are nonetheless long-established institutions rendering an effective specialized education service. The private post-secondary institutions probably enroll about as many students beyond high school as do the public ones, but they usually graduate and place a larger proportion of their students. (This does not include home study correspondence schools.).

Employers of all Kinds, Both Private and Public

A great deal of the career education beyond high school is obtained on the job but enhanced and completed by part-time attendance of informalized classroom laboratory or clinical educational programs. Examples are clinical programs for nurses, preparation of law enforcement officers, and cooperative education programs for technicians of all kinds. Apprenticeship programs for specialized craftsmen and service workers whose work involves the application of more complicated and interrelated technologies, particularly those spanning more than one major field of knowledge such as electrical and mechanical maintenance, are other examples.

The contribution of employers of all sorts to specialized occupational education by providing on-the-job training and work experience will become even more important in the future. The advantages of cooperative education programs or comparable internships have been recognized since the preparation for scientific careers began. The internship served by medical doctors to learn how to heal by healing is little different except in degree from the many specialized work experiences required by modern technical workers in most fields. The reality of on-the-job training provides experiences which cannot be simulated in a school situation and permits the learner to gain some degree of self-support, to gain respect for himself and for the experienced masters of the work, and to learn the practices of the system within which he will work. More cooperative programs will be needed to prepare people for the very specialized kinds of work that cannot practically be simulated in a laboratory.

HIGHLIGHTS OF CCUC/4

A monkey falling from a tree narrowly escapes the bullet aimed at him. A runner sees both ends of the pole he carries, even though the pole is exactly as long as the barn through which he runs. A student learns how he learns by conducting an experiment with himself as the subject.

The common thread of these seemingly unrelated events is CCUC/4, the Fourth Annual Conference on Computers in the Undergraduate Curricula, held in Claremont, California on June 18-20. Academicians representing a multitude of disciplines told of their computer-related successes, failures, frustrations and experiences in their attempts to use computers for instruction.

The monkey falling from the tree was the creation of Dr. David Yu of SEATTLE PACIFIC COLLEGE, who has found numerous ways to use the school's RSTS-11 system for problem solving in his physics class. At the moment the monkey falls from his branch, the student fires a computer-simulated shot from a rifle aimed at the monkey. The problem is to choose the initial velocity of the bullet so as to just hit the monkey.

Dr. Yu's simulation generated so much interest among his students that they quickly modified it to be a game. The student now selects the height at which he will hit the falling monkey as well as the initial velocity of the bullet. The modified program illustrates both free fall and projectile motion simultaneously.

The computerized runner with the pole had his origins at SOUTHERN OREGON COLLEGE, where his reason for being is to illustrate time-space problems. Tim Kelley, at Southern Oregon, tells how pictorial representations are necessary to convey the concepts of such a complex topic. However, drawing diagrams on the blackboard consumes a great deal of class time and does not portray the concepts with sufficient precision. Using drafting services and slide production proves expensive and inflexible. Computer graphics provides the answer, as the professor can draw complex space-time diagrams quickly, precisely, step-by-step, on-line, during class, and he can alter them any way he or the students see fit to illustrate a point.

One of the most innovative of CCUC's attendees was William Bewley from LAWRENCE UNIVERSITY. Dr. Bewley has the school's RSTS-11 system illustrating learning theory to his psychology students in a personal, unique and effective way. The computer performs three functions—it generates stimuli, it runs experiments using the students as subjects, and it runs computer simulations.

The stimuli appear on the computer terminal, which could vary from a teletype or hard copy device to a CRT or graphics terminal. In one experiment, the stimuli consist of 20 lists of letters which the student scans for a particular "target." In another, the stimuli are pairs of letters which have varying sizes, colors, and dimensions. For each pair of letters the student must identify which of the letters coincides with the "concept." The "concept" here is one of the letters' dimensions, such as LARGE, BLACK, LEFT or X.

Dr. Bewley has arranged for the student to obtain a good measure of his performance in an experiment of this sort. While the student is participating in the experiment, the computer "presents" the stimuli to a computer simulation of human behavior. Students can then compare their behavior patterns to the model. By varying parameters within the simulation model and repeating the experiment, students learn both about the behavior patterns the model represents and about their own behavior. Involving the students in such "laboratories in learning" greatly enhances their interest and enthusiasm for the subject matter and thereby improves their understanding.

Dr. Bewley's latest experiment combines a game-like atmosphere with the experimental approach he used in his initial endeavors. Subjects play the well-known cannibal-missionary game, in which they try to transport three cannibals and three missionaries across a river in a craft without ever allowing the missionaries to be outnumbered. Their progress, as in other experiments, is monitored by the computer.

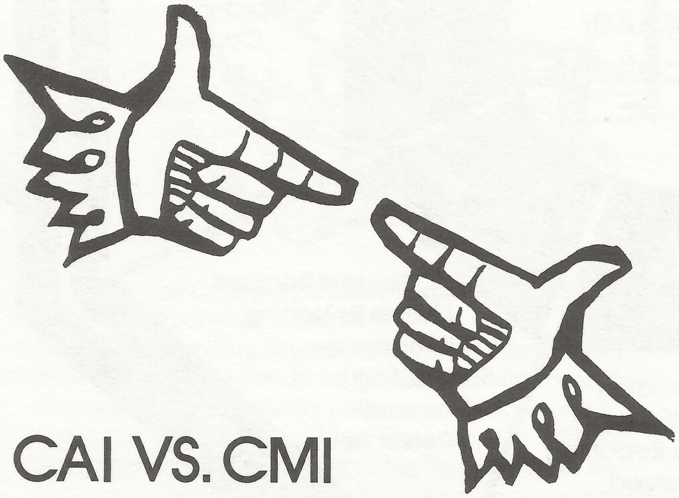
LAWRENCE had a second representative at CCUC, too. Dr. Brandenberger from the physics department uses a PDP-11 to teach a course in laboratory computing. He has strong views regarding the computer's use in natural science education. He recommends that "any department that sees fit to equip its undergraduate laboratories with sophisticated instruments...costing in the neighborhood of $10,000 to $15,000 each, should begin to think in terms of developing a laboratory computing capability during the next five years."

The aims of his course are to "survey the principles of laboratory computing, introduce students to assembly language programming, convey an appreciation for the trade-offs involved in high versus low-level programming for laboratory applications, and reinforce the formal

material in the course by requiring that each student develop, program, and execute an on-line, real-time, computer controlled experiment of his own choosing." Materials for the course consisted primarily of manuals and handbooks published by DIGITAL.

Even the social sciences were represented by DIGITAL users at CCUC. Stephen Cutler from OBERLIN COLLEGE described his use of the school's RSTS-11 system in an introductory sociology course. Dr. Cutler's course teaches computer based research techniques including the structure of data sets and statistical analysis.

CCUC featured a host of informal evening discussions on a multitude of topics. The presence of DIGITAL users was as obvious here as in the formal sessions, and some impressive accomplishments were revealed. Robert McCroskey from WHITWORTH COLLEGE told of the school's PDP-11 CAI language, developed by the school's Spanish Department Chairman, Ron Turner. Al Bishop from MILLSAPS COLLEGE discussed how his school has integrated their EduSystem 25 into nearly every aspect of the school's curriculum. Darryl Johnson, from BENTLEY COLLEGE, impressed the crowd with his rapid introduction of a comprehensive interactive library on the first PDP-11/40 RSTS/E installation in existence. Jim Warden from WABASH COLLEGE demonstrated DECADE, a long range planning language designed to run on the school's RSTS-11 system. All these applications are so exciting that they deserve feature stories of their own. See future issues of EDU for more!



CAI VS. CMI

By Warren H. Hill

During the past decade, CAI has become a familiar concept in the romance between computers and education. From their initial introduction in education, computers and computer-assisted instruction have been looked upon with both awe and dismay. Some educators have viewed the pair as a cure-all for the ills of education and the ultimate for individualized instruction, while others have denounced computers as yet another way of dehumanizing education. Actual experience has shown that this has not been the case, and what has evolved in the past ten years has approached neither extreme.

Recently, some persons disenchanted with the use of CAI have been exploring alternative strategies for the use of computers in the classroom. One of these alternatives introduces another acronym, CMI. The concept of Computer Managed Instruction envisions a "Computerized Man-Friday" that is used by the teacher to assist in student record-keeping and the evaluation of student progress.

There are two immediate implications in the use of CMI. First, the student is not usually interacting with the computer, and consequently, the cost of CMI as compared to CAI is considerably less. The second factor is directly related to the first: since the student is not interacting with the computer, no instructional materials are stored in the computer, and the emphasis is placed upon record-keeping.

For an in-depth consideration of CAI and CMI, readers are referred to the following articles:

Brudner, H. J. "Computer-Managed-Instruction". *Science*. Vol. 162.

Gibb, E. G. "The Computer—A Facilitator in Management and Instruction". *The Mathematics Teacher.* Vol. 66, No. 1, 1973.

Gorth, W. P. and D. W. Allen. "An Introduction to Comprehensive Achievement Monitoring (CAM): A Project to Develop Longitudinal Classroom Evaluation Using Item Sampling," a paper presented at the Annual Meeting of the National Council of Measurement of Education, New York, February, 1971.

Gorth, W. P., D. E. Schriber, and R. P. O'Reilly. *Comprehensive Achievement Monitoring: Its Design and Use.* Amherst, MA: School of Education, University of Massachusetts, 1971.

Heisey, Daniel J. "A Primer on Assessment," paper presented at NCTM Annual Convention, Chicago, April, 1972.

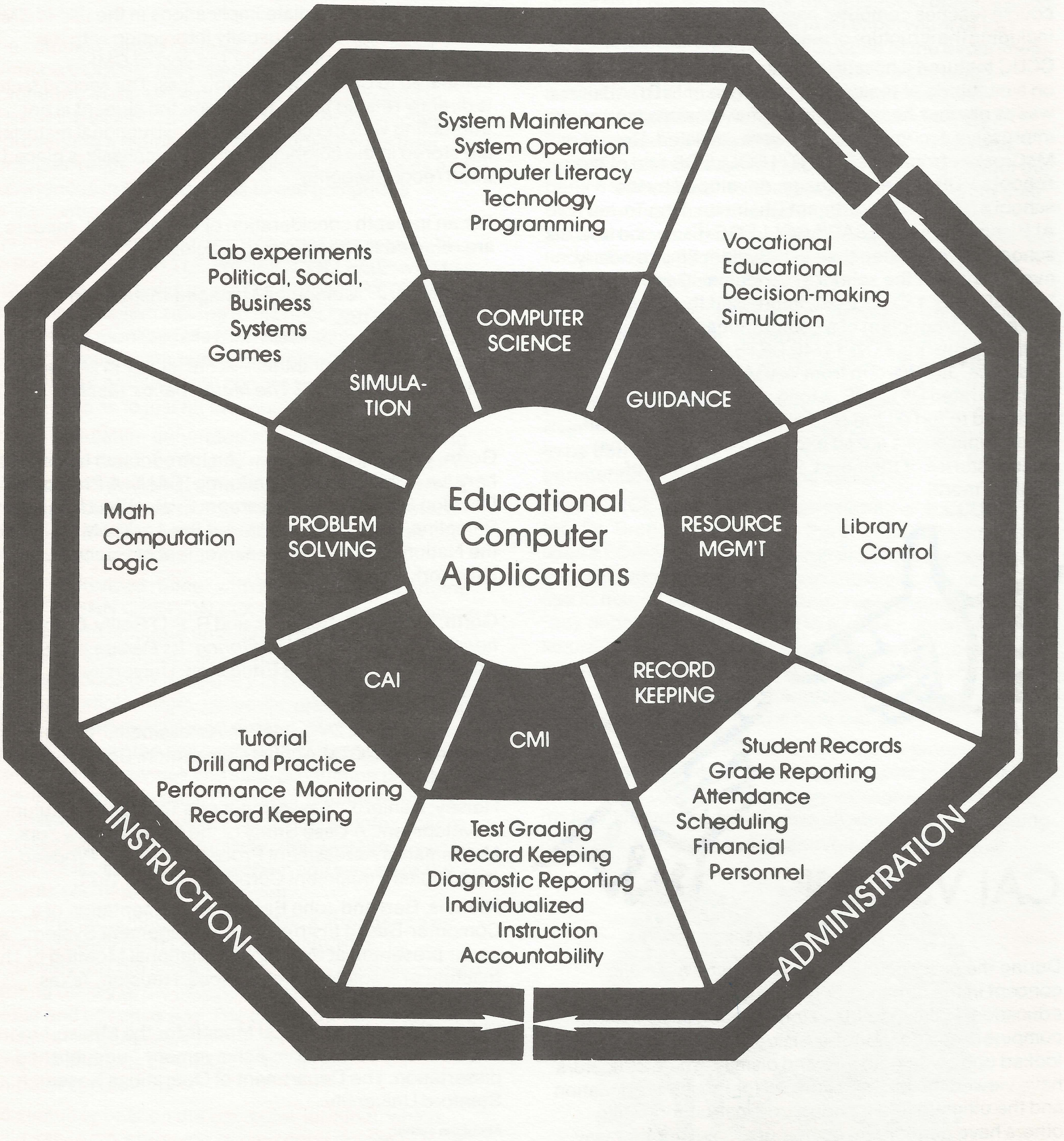
Heisey, Daniel J. "Assessment as a Tool for Curriculum Development: A Case Study of the Greece, New York, Mathematics Assessment Process," *DECUS Proceedings,* Digital Equipment Corporation, Fall, 1971.

Niehuis, Bert and John Easter. "Implementation of a Computer-Based Instructional Management System," a paper presented at the 19th International Meeting of The Institute of Management Sciences, Houston, Texas, April, 1972.

Pinsky, P. D. "Mathematical Models for the Measurement and Control of Classroom Achievement," unpublished dissertation, The Department of Operations Research, Stanford University.

About the author:
Dr. Hill is an Associate Professor of Mathematics at Westfield State College, Westfield, Mass. He holds an AB degree from Keene State, MST from University of New Hampshire and a PhD from Peabody College. His computer interests include educational research, secondary school computer use and membership in the Mass. State Information Systems Task Force on Computer Usage. Dr. Hill is a guest editor of this issue of EDU.

Everyone seems to have his own opinion regarding the categorization of the myriad applications of computers in education. We at EDU offer this graphic representation for your classroom, for your next presentation to the school board, or for that in-service program you've been planning.



APPLICATION STORIES

VACATION WITH THE COMPUTER?!!

A wonderful thing happened at Lockport H.S. in Lockport, Illinois this summer! From August 12-16, the school sponsored a workshop entitled "VACATION WITH THE COMPUTER"; the five-day session was designed to introduce several hundred students (and teachers, too!) to the school's new EduSystem. For a $15.00 fee students took advantage of their free time to learn the BASIC language, discover the capabilities and limitations of computers, and as Ken Lebeiko, director of the program, advertised, to "enjoy their vacation"!!

Lockport High School's EduSystem 45 consists of a PDP-8/E computer with 12K of memory, a dual DECtape drive, a mark sense card reader, a 165 chr/sec line printer, a 1.6 million word cartridge disk, 3 teletypewriters and a VT05 CRT display terminal. Lockport plans to offer three computer courses in the 1973-74 school year.

Wouldn't a "VACATION WITH THE COMPUTER" be a great program to institute in your school this year?

COMPUTER TECHNOLOGY AT LOS ANGELES PIERCE COLLEGE

The Computer Technology program at Los Angeles Pierce College in Woodland Hills, California, educates and trains high caliber Maintenance Technicians and Field Engineers. The first year of the program covers basic circuitry with emphasis on the network theorems and digital circuits. The second year is devoted to the total system operation with a strong emphasis on diagnostics. The program was started in 1970 and currently enrolls 80 students.

Professor E. Charles Alvarez and John W. Tontsch developed the program to have good rapport with the community. They have a tight alliance with industry through an aggressive advisory committee, and an annual industry fair at Pierce College allows local companies to display their digital equipment to students and public. Also, a National Science Foundation sponsored program brings 11th and 12th graders to Pierce College where they can earn credit for the first semester of Computer Technology in their last two years of high school. Further, Professors Alvarez and Tontsch have developed an A-V slide program which they present at every high school open house in the schools of their district.

An 11/40 medium-scale timesharing computer system was recently acquired by the school for incorporation into the computer technology program.

The major course requirements at Pierce include:

Man and the Computer Age	(3 units)
Fundamentals of Computer Circuits & Lab	(5 units)
Computer Logic & Arithmetic & Lab	(4 units)
Computer Math I	(4 units)
Programming for Computer Technicians	(3 units)
Computer Math II	(3 units)
Computer Electronics & Lab	(4 units)
Electromechanical Components & Lab	(4 units)
Fundamentals of ICs	(4 units)
Storage Principles & Devices	(4 units)
Input/Output Devices	(4 units)
Computer Project	(2 units)
Digital Computer System	(4 units)

RSTS/E AT BENTLEY COLLEGE

Bentley is a four-year private college of business and accounting serving approximately 2,300 students. The college recently moved from Boston to a new campus in Waltham, MA.

The following article is reprinted by permission from the college newspaper, the Bentley Observer.

An exciting, sleek addition was recently made to the college's excellent computer facilities. This has been a major accomplishment through the efforts of Dr. Ralph N. Johanson, outgoing coordinator of academic computing activities, who has worked with the development of computer activities and related facilities at the college since 1966.

Installed in the Computer Center on the ground floor of Lindsay Hall is an ultra-modern computing system—a PDP-11/40 RSTS/E system. The installation of the PDP-11/40 represents a major milestone in the growth of academic computing at the college.

The acquisition of this sophisticated, versatile time-sharing system provides the college with its own in-house academic computer dedicated to instructional and research purposes, allowing the college to disengage from its present reliance on restrictive computer facilities and arrangements at other institutions.

"The new time-sharing computer system has been a long-awaited and needed addition for the broadening and strengthening of our academic programs," said Dr. Johanson, principal planner for the RSTS/E system.

The availability of the PDP-11/40 removes a straight-jacket allowing for greatly expanded capabilities, facilities and user services than heretofore. Students and faculty can now look forward to having easy and ready access to the RSTS/E time-sharing system which, as needs develop, can be easily expanded to support up to 32 simultaneous users, each of whom is unaware of others using the computer. It is expected in the years ahead that this advanced PDP-11/40 system will play an increasingly significant role in the accomplishment of the College's broadening objectives.

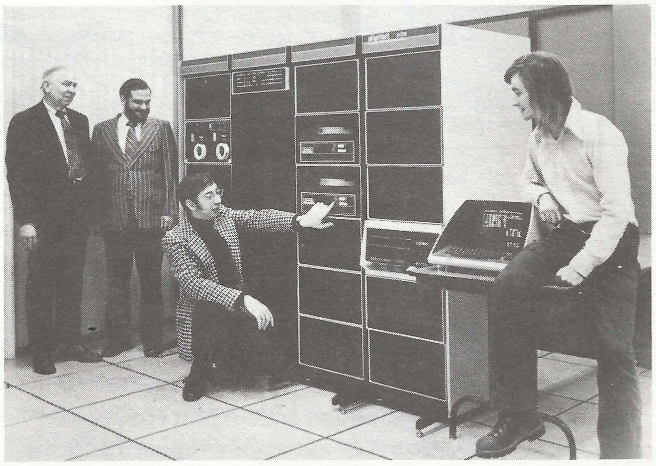
With time-sharing, the community of Bentley College users can interact directly with the computer, obtaining immediate response to inquiring and ready solutions to problems, as opposed to putting up with more complex procedures and discouraging delays using conventional batch computer facilities, according tc Dr. Johanson.

Communication with the PDP-11/40 system is principally by means of the easy-to-use BASIC-PLUS time-sharing language, a powerful extension of the BASIC language widely adopted by leading undergraduate and graduate schools. In many subject areas much more complex and realistic problems can now be assigned, difficult and tedious detail eliminated and relatively simple solutions obtained using more effective computer-oriented approaches to problem-solving.

The RSTS/E time-sharing system is ideal for running highly interactive group and class simulation and gaming activities. Experiments in the social and physical sciences involving statistical analyses of large amounts of real and/or computer-generated data are easily performed with significant results made readily available. Users can conveniently access a substantial, expanding library or stored business applications programs without having to become involved with the details of computer programming.

Exciting possibilities exist for the development of computer-assisted instruction serving many disciplines.

Instructional systems built around stored files and data bases can be implemented to provide expanded opportunities for problems and projects in courses and research involving simulation studies in business, the sciences and the humanities. Experimentation and development of on-line administrative applications can be of significant help to make readily available more effective and responsive decision-making capabilities to serve the College administration.



The PDP-11/40 system includes over 80,000 characters of core memory, a 500,000 character fixed-head disk, two mass-storage cartridge disk drives (total capacity of 5,000,000 characters), a dual DECtape unit, a DECwriter terminal, a TV-type display terminal and associated communications equipment.

The initial installation is supported with nine teletypewriter terminals for communication with the computer—six directly connected (hard-wired) and three dial-up (via phone lines). With appropriate arrangements with other cooperating institutions, the dial-up terminals can also be used to access their remote time-sharing computer facilities. This makes available to the College special programs, systems, and related resources at cooperating institutions which are not available on the Bentley College system. In addition, the College has three portable terminals which can be conveniently used by faculty at home or in their offices via regular telephone links to the computer.

RSTS FOR HIGH SCHOOL ADMINISTRATION

North Country Union High School located in Newport, Vermont, is using their DIGITAL PDP-11/20 system to perform a wide range of administrative applications. Under the direction of Cy Benson, Principal, and Ralph Caye, Business Manager, implementation of many administrative packages in the BASIC-PLUS language of the RSTS (Resource Sharing Time Sharing) system have been completed. In fact, many of the programs were used during the 1972-73 school year.

Application areas include accounts payable, hourly and salaried payroll, and bank reconciliation, as well as employee master and ledger master file maintenance systems. A student information file has also been implemented and from it, reports such as quarterly grade cards and student transcripts are generated.

Accounts Payable
To handle the school district's accounts payable, a vendor master file was first created and is maintained on disk storage. Purchase orders and invoices are keypunched and the transaction file is then updated. From the invoice records, a voucher list is prepared for school board approval prior to payment. When payment is approved, the checks to vendors are prepared and a check file created for bank reconciliation. The ledger master file is also updated to reflect new year-to-date totals, and an expense ledger showing the current status of accounts is printed.

Payroll
A series of programs was written which maintains an accurate employee data base. With the file maintenance programs, employees may be deleted, new employees added, or changes made on pay rate or type and amount of deductions.

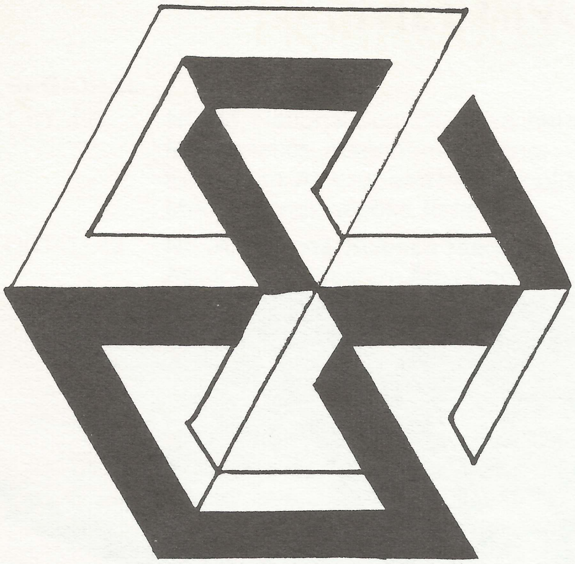
For hourly employees, the number of regular and overtime hours worked is entered and the gross amount calculated. This first step is skipped for salaried employees; but for all employees, federal, state, and FICA taxes are calculated and the employee master file updated with new year-to-date totals. Payroll checks are printed, as well as deduction reports and a payroll register. Transaction records are simultaneously created to update the ledger master file and check file for bank reconciliation.

Bank Reconciliation
Under the bank reconciliation system, a card is keypunched for each cashed check (from either the accounts payable or payroll system). The system purges the check file and lists checks cashed and checks outstanding. Provision is also included for hand-written and voided checks.

Many schools like North Country Union H.S. in Newport, VT, are using DIGITAL EduSystems for administrative and instructional applications.

Student Information System
Programs to maintain an accurate student data base have been developed as part of the student accounting application area. Attendance reports, quarterly report cards and transcripts can then be printed from the data stated in the student file. By centralizing the student information in one readily accessible location, the guidance department claims a time saving of up to 30 percent in pre-counseling data retrieval.

John F. Miller, Data Processing Manager of the Newport System, has used BASIC-PLUS exclusively in implementing this wide range of administrative applications. He has found the unique BASIC-PLUS features of virtual arrays, file handling capabilities and formatted output helpful in performing administrative jobs effectively, while RSTS allows the system to simultaneously perform instructional timesharing.



MATH WHIZ KIDS CONVENE AT HAMPSHIRE

Sixty highly talented and motivated senior high school students convened at Hampshire College for six weeks this summer in a program entitled, "Processes of Mathematical Thought". This program marks the third in the series of NSF-sponsored summer institutes in mathematics at the campus in Amherst, Mass.

Students chosen from all parts of the U.S. were actively involved in analyzing problems, seeking patterns and generalizations and applying knowledge to the creation of proofs. Emphasis in the studies was placed on **discovery** rather than on accumulation of results. The program schedule included four hours of class work and several hours of small group study. The staff of professional and student mathematicians sought to create an atmosphere of enjoyment, sharing and creative thought.

In addition to the many facilities on the Hampshire Campus, the collective resources of Amherst, Mt. Holyoke, Smith and the University of Massachusetts were available for participants. Students were given the opportunity to use a PDP-8/E computer system, provided by DIGITAL, for their coursework.

For additional information regarding the Hampshire College Summer Studies Program contact:

Mr. David C. Kelly,
Director of Summer Studies
Hampshire College
Amherst, MA 01002

NINE PRIVATE SCHOOLS FORM CONSORTIUM

Nine Catholic high schools in New York City have pooled their resources to form what is believed to be the largest computer timesharing network operated by any private secondary school in the country. The system, located at LaSalle Academy in Manhattan, was developed to provide high-quality education to the city's Catholic schools in the face of rising educational costs.

LaSalle's EduSystem 50 (TSS/8) is used for instruction and administrative work by St. Raymond's Boys, Bishop Dubais, All Hallows, Cardinal Spellman, Immaculate Monsignor Farrell, and St. Peter's High Schools, as well as by St. George's and LaSalle Academies. The educational computer system is based on the PDP-8/E minicomputer and is linked to the cooperating schools via telephone lines. More than 1200 high school students are benefiting from the computer instructional program in the nine schools.

After only one year of operation, the consortium supports terminals in the nine institutions , and LaSalle is exploring the possibility of expanding the network size, as well as the computer services. Warren Eisenberg, Chairman of LaSalle's Computer Department, is proud of the success of the program (the system is in use 24 hours a day, 7 days a week!). In fact, computing at LaSalle is so popular that Mr. Eisenberg is forced to do his own work on "quiet Sunday evenings"!

The EduSystem 50 is used to teach students computer programming and technology. The program of instruction is based on the needs of industry; BASIC and FORTRAN programming and computer familiarization are widely taught. Teacher training courses that prepare instructors to conduct computer classes are provided yearly at an economical cost. Administratively, LaSalle's system handles attendance, record-keeping and tuition/bookkeeping functions. Some of the schools are also using the computer for scheduling guidance sessions.

By establishing the consortium, LaSalle has been able to bring the cost per student of the computer system to an extremely low rate, thus providing a vitally important educational service to the city's Catholic schools.

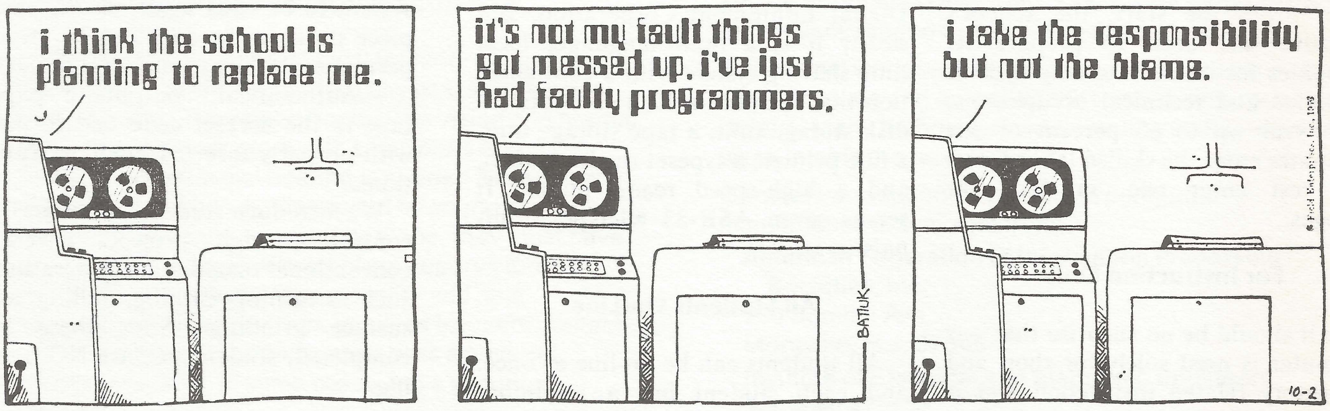
> *"Art is long, life short; judgement difficult, opportunity transient."*
>
> —Johann Wolfgang Von Goethe

ADULT VOCATIONAL EDUCATION

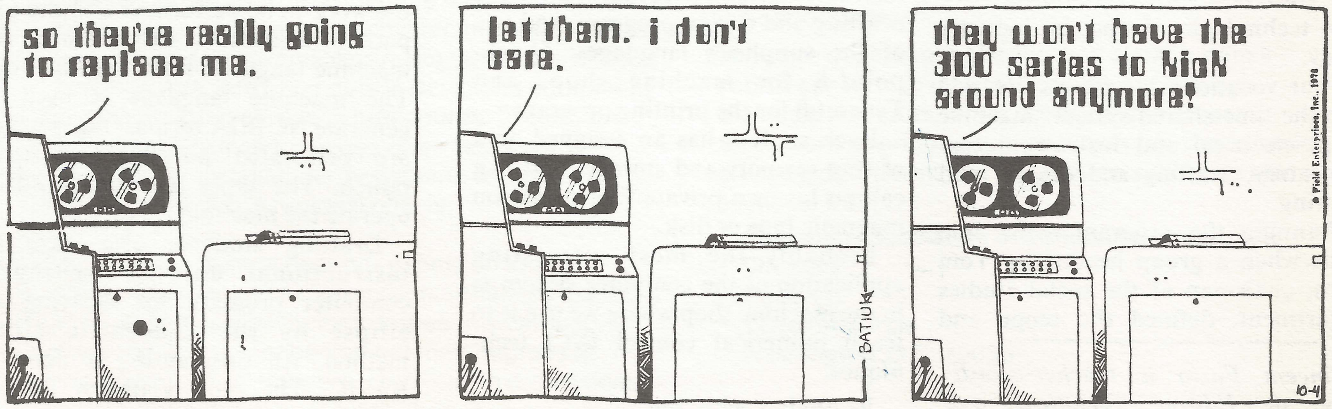
Douglas High School in Douglas, Arizona, in cooperation with the Arizona Office of Education and Phelps Dodge Corp., recently sponsored an adult vocational evening course in PDP-8/E BASIC Programming. Twenty-five students were awarded certificates of course completion. The course included an introduction to flow-charting and programming in BASIC and was designed to provide computer knowledge to community members.

Douglas High School will use their EduSystem 40/EDP to handle administrative work including attendance, grade reporting, and student scheduling. Dave Rabago, Douglas Business Manager, explained that administrative applications already implemented are payroll and student activity fund accounting, and future applications will include statistical surveys, purchasing, inventory and budget work. Instructionally, the computer is used in math, science and business education courses.

FUNKY WINKERBEAN By Tom Batiuk


i think the school is planning to replace me.
it's not my fault things got messed up, i've just had faulty programmers.
BATIUK
i take the responsibility but not the blame.
© Field Enterprises, Inc. 1978
10-2

FUNKY WINKERBEAN By Tom Batiuk


so they're really going to replace me.
let them. i don't care.
BATIUK
they won't have the 300 series to kick around anymore!
© Field Enterprises, Inc. 1978
10-4

A Computer System for Students Only

By Vincent Fazio

WHEN should a well-established technical and industrial high school make its move to computer oriented instruction?

A little more than two years ago, we at Edison Tech in Rochester, New York, decided the time had arrived. As a result, we launched what we call our Computer Oriented Multi-Technical Skills program in February, 1972.

Implemented with a $100,000 computer system, the program's prime purpose is to integrate the use of computer technology with industrial applications, thus fulfilling the rising demand for technically skilled workers with a good understanding of computer applications within their trade and skill areas.

Organized in 1908, Edison Tech is the oldest vocational school in the state. From the start, the school's objective has been to prepare its graduates for immediate employment in skilled and technical occupations. Each year up to 65 percent of our graduates enter the skilled labor force. The rest enter two- or four-year colleges.

For Instruction Only

So it should be no surprise that our computer is used solely for shop and laboratory related instruction and is not used either as a school administrative tool or as a homework aid for students. The system is designed to give the student a broad exposure to the state-of-the-art techniques and new technologies found in industry today.

Four vocational programs are tied into the time-shared system: machine shop, electrical and instrumentation laboratory, drafting and design, and printing.

Planning the program came into focus when a group headed by Tom Coch, chairman of the social studies department, defined the scope and objectives and structured the multi-technical approach we had in mind.

In next approaching the choice of a hardware/software package, we agreed that the system had to provide the package at minimum cost and at the same time satisfy a rather diversified number of applications.

Two major selection criterions were established:

—Cost/performance—There was no point in selecting hardware with features that would never be used, but would have to be paid for, and

—Use-oriented system—User orientation hinges around the I/0 features of the computer and the software availability.

After measuring four systems against our criterions we selected a general-purpose, minicomputer-based system, known as EduSystem-50, from Digital Equipment Corporation. Basically it is a multi-language, local time-sharing system with a configuration that includes a 12 k computer, a disk storage unit, a tape storage unit, a line printer, a typeset reader/punch, and a high-speed reader/punch. It serves seven ASR-33 teletype terminals.

All Students On-Line

All students can be on-line at once, and each student has a minimum delay "hands-on" contact with the computer. Three languages are available. depending on the problem. We use BASIC for the electrical and instrumentation program and the drafting and design program, and two of the supplier's languages: Quick-point-8 for machine shop, and Typeset-8 for the printing program.

Each student has an assigned area of core memory and storage, and can call on his own private files stored on magnetic tape or disk.

Probably the most interesting application of the computer system is in the machine shop where we use it to teach numerical control (NC) techniques.

Beginning with the "blueprint," the programmer writes a program manuscript that describes the tool motion and other operations required to produce the work. The program is written in machine language and then converted to punched tape which, in turn, controls machine motion.

Use of the computer machine language for NC tape preparation offers a number of advantages over manual tape preparation:

—Eliminates virtually all computational work by allowing input coordinates to be either absolute or incremental.

—Uses shorthand symbols for defining geometric patterns such as grids, bolt-hole circles, and various arrays.

—Allows parts programmers to define either geometric or random patterns. Once defined, these patterns can be stored temporarily in the system to be used again on the same piece part, or the data can be stored permanently for use on different parts.

—Automatically outputs a paper tape in the correct code and format, with properly inserted auxiliary functions.

We introduce students to numerical control through projects covering conventional machine tool operations, such as turning, drilling, milling, and surface grinding. After these are completed, students receive NC training.

Multi-Skill Application

The drafting students prepare the NC drawing which shows positions of the work to be performed and the tool path. Machine shop students write the machine language from this drawing. The machine language is used to generate NC (EIA format) tapes which are perforated on the high-speed punch. The tapes are then used to operate the machine.

Drafting students also have an instructional unit in writing a computer program for drawing an ellipse by the concentric circle method. All programing is done in BASIC. The plot is drawn on the plotter.

For the electrical and instrumentation laboratory program, we developed

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Vincent Fazio is teacher-coordinator at Edison Technical and Industrial High School, Rochester, New York.

a new teaching approach which represents a real-life situation where thinking and planning precede the circuit construction and measurements. Instruction involves problem solving by simulation followed by laboratory experimentation. Students prepare project programs in the BASIC computer language.

Each application is divided into two phases. In Phase I, the problem is described completely and the student attempts to write the computer programs which will simulate the actual situation. Phase II instructs the student to build the actual circuit and to make various measurements. Results are compared as a means of self-evaluation.

A student is instructed to write a computer program to calculate the voltage charge on a capacitor in relation to the time the voltage is applied, and then to construct a breadboard circuit and compare results with computer predictions. The problem is broken down into the following components:

—Write and run a computer program to compute the charge on a capacitor in relation to the time that the voltage has been applied. Program is written in BASIC language. A sample program is shown in Fig. 2.

—Measure charge on a capacitor at the time intervals listed. Check computer results against actual circuit measurements.

Exploration in Old and New

The printing course gives students a chance to explore most phases of letterpress printing as well as bindery operations. Equipment consists of two typecasting machines, four platen presses, one cylinder press, a wide variety of hand type, a phototypesetting machine, and bindery equipment.

Students usually enter the course in their sophomore year and start by setting a prescribed number of lessons in handset type. When the student has finished these lessons he moves on to presswork or any of the other skills offered. In this way he can find where his interests and abilities are strongest.

Seniors are kept busy polishing their skills and giving a helping hand to juniors. If, at mid-semester, a student has passing grades in all subjects, he is eligible to work days in a local printing company. He no longer attends shop at Edison, but spends his time working in a real shop environment.

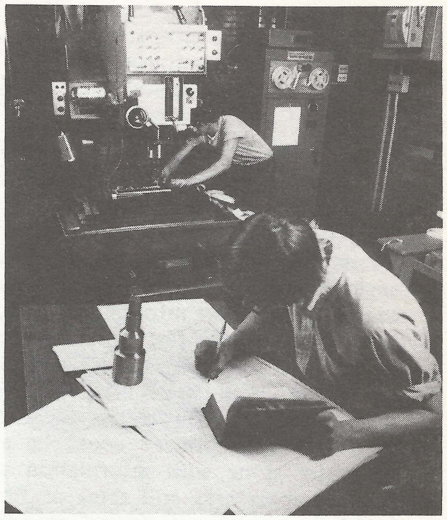
The computer oriented program helps the printing student learn computerized phototypesetting and editing techniques used in the industry. Our phototypesetting equipment is compatible with the computer system and permits a wide range of operations, including justification and hyphenation, variable width word spacing and letter spacing, two-magazine mixing, variable column width, standard indents, flush and hanging formats, column cutting for runarounds, tabular quadding, and text wirestripping and tabular resetting.

All of the operations are keyboard-controlled by the perforator operator. Copy is transferred to a six-level paper tape for processing, but no special perforating machine is required. These input tapes can be prepared on any device that produces a six-level paper tape in TTS code.

The initial typesetting instructions for the program are typed at the beginning of each input tape, and give the required typeface, point size, and column width. Format variations and further instructions are given by interspersing commands within the copy as it is typed. Commands are simple and easy to remember and soon become as familiar to the student as any other notations associated with typesetting.

Input tapes are punched in the print shop. The student then takes the tape to the computer room where he processes the tape with limited assistance from the instructor. A tape reader at the head of the system interprets the instructions for end-of-line decisions involving justification, hyphenation, etc. The new configuration is punched on an output tape. A proof copy is also produced on the line printer.

With the proof copy and the output tape, the student returns to the print shop to complete the process. This procedure, incidentally, will be updated before the end of this school year with additional equipment by which the student will be taught storage and line-by-line editing procedures in the computer room.



Drafting students prepare the numerical control drawing which show tool path and work positions. Machine shop students then use machine language to write the program to be punched on tape for machine operation.

COMTS an Important Step

Implementation of the Computer Oriented Multi-Technical Skills program at Edison Tech marks an important step in the history of the school and its future development. Here, in brief, is what has been accomplished since the computer system was installed less than 18 months ago:

—Every ninth-grade student from the instrumentation laboratory has had an opportunity to learn some BASIC language, and logging-in and logging-out procedures.

—Machine shop students are taught to read a numerical control drawing; to write a program using machine language; to prepare a tape on the tape punch; to process tape on the computer to produce an EIA format tape; and how to run the numerically controlled machine tool. Drafting/design students had the same instructions as the machine shop students.

—Eleventh- and 12th-grade students are instructed in BASIC computer language. Electrical students write programs to simulate laboratory experiments.

Print shop students are taught the Typeset-8 system by going through the basic procedures from punching the input tape through production of camera-ready text. Additional software has been purchased to allow students to store and edit the text line-by-line by using a line printer for proofreading. ☐

COMPUTER GRAPHICS ON EUROPE'S FIRST PDP-11/45

Making Computer Graphics available to a wider range of end-users is the ultimate aim of an applied research and development project currently running at the Faculty of Mathematical and Physical Sciences of Nijmegen University, Holland.

Computer graphics is the construction, manipulation and analysis of pictures with the aid of a computer. Once a designer has entered a drawing into the computer's memory, it can be scaled or rotated with a variety of interactive controls and viewed from any angle or perspective. More importantly, the computer can be given other information such as the diameter of a pipe in a blueprint or the strength of a wall in an architectural drawing and can then combine this information with the geometric description to analyse the various properties of the drawing. Thus the plans of a large oil refinery could be entered into the computer along with information about pipe sizes, fluid temperatures and rates of flow. An engineer could then request a display of stresses experienced by a particular pipe, the total length of piping in the system or the rate of output of the refinery.

While applications for computer graphics range from engineering design and mathematical analysis to pure art, its potential is far from being realised because of the high cost of setting up a graphics display system.

Under the direction of Professor Andries van Dam, the Nijmegen project aims to make computer graphics not only cheaper but also more widely available and more powerful by providing more sophisticated hardware and software.

"We are not trying for a 'Graphics for the Millions' formula", says Professor van Dam. "But we would like to break through the cost barrier that inhibits the current growth of computer graphics. For example, we would like to see a larger range of problems solved with computer-aided design".

A first step has been work on a series of FORTRAN subroutines which would allow a science-oriented person to get into graphics without six months' intensive training. Following this, the project hopes to establish a set of benchmarks or qualitative guidelines for computer-aided design projects carried out on powerful satellite configurations.

To aid its development work, the University has just taken delivery of the first PDP-11/45 computer in Europe. The computer from Digital will be used in conjunction with a Vector General graphics display. The system – a medium-sized DOS configuration – consists of PDP-11/45 processor, 16K of core memory, one RK11 moving-head disk drive (1.2 megaword capacity), two DECtapes and a 300 cards per minute card reader. A 165 cps Centronics printer is also included. The Nijmegen project will develop its own special, sophisticated graphics software for use on the 11/45.

"Computer graphics have been slow to develop" says Professor van Dam, "because the technology is still too difficult and expensive. In early configurations, the display unit was always linked directly to a large host computer such as an IBM 360 or UNIVAC 1108. Even for the smallest jobs the large host had to do the work. DEC pioneered a system whereby a mini-computer intervened between the host and display console. An early example of satellite computing, this enabled many more small problems to be solved with computer graphics".

"Satellite computing leads to a division of labour. Small tasks can now be done locally. The large host computer need only be involved for big computation jobs or large data-based storage. Some of our current work at Nijmegen is studying how best to divide the labour. Where do you draw the line? Which jobs are for the satellite and which are for the main computer? Most of the available equipment for satellite computing is still too expensive to perform only small tasks. At the same time it is often not powerful enough to use on larger jobs. Satellite computing has proved useful but if 75% of the interactive tasks still require access to the host computer, it doesn't offer enough".

The problem hinges on the power of the satellite. Professor van Dam refers to 'critical intelligence' as a threshold of power required of the satellite to meet such a 75%-type criterion. It can be measured in terms of speed, instruction set, core/disk capacity and software. To achieve 'critical intelligence', the satellite and display unit must be as powerful as possible. Clearly, the greater the power, the greater the number of tasks which can be handled by satellite rather than host – in this case an IBM 370/155.

"Although the other computers we considered were lower priced, the PDP-11/45 linked to the Vector General gave us the power we were looking for", says Professor van Dam. "The 11/45 instruction set rates better than its competitors and its floating point processor is an excellent feature. Its memory management features are also attractive. The 11/45 allows us to write more sophisticated programs and the more sophisticated the software, the more sophisticated tasks it can handle. The machine has its flaws but basically we are happy with it. Certainly in a university environment the fact that it is more sophisticated and future-oriented allows students and researchers to get more out of it".

The work at Nijmegen is being done in co-operation with the Technical University of Delft and with Cambridge University. Of late, there has also been increasing co-operation with a government clearing house and development group for computer-aided design, known as the Cambridge C.A.D. Centre. Eventually, all three universities will have the same type of hardware. An early result of the co-operation between Nijmegen and Delft has been software which will emulate the IBM 2250 display unit on the PDP-11/45/Vector General hardware.

The Nijmegen project runs parallel with work at Brown University in the United States where a team at the Center for Computer and Information Sciences has been investigating ways in which the high cost of computer graphics programming and production operation can be reduced by satellite graphics. The team at Brown is also under the direction of Dr. van Dam who is Associate Professor of Computer Sciences at Brown and Guest Professor of Computer Sciences at Nijmegen on a Fulbright Grant.

More-or-less commuting between Brown and Nijmegen over the last year, Professor van Dam explains the differences in the projects as: "At Brown we are concentrating on fundamental research to the extent of customising some of our own hardware. At Nijmegen our aim is more to put together some very useable programs exclusively on commercially-available equipment".

SOURCE MATERIAL FOR EDUCATORS

MATH FOR THE ADVANCED

We've had so many nice compliments from our users and our readers regarding *ADVANCED PROBLEMS FOR COMPUTER MATHEMATICS*...that we want to talk about it again (and again???).

ADVANCED PROBLEMS is a 75-page collage-like set of mathematics problems designed by Bob Albrecht of DYMAX, Menlo Park, CA. Published one year ago by DIGITAL, this volume has been greeted with exceptional success! We dare to say that it stands alone as the most outstanding collection of mindboggling, brain-dazzling problems for computer solution available anywhere! If you're looking for some ideas to keep those advanced students busy this school year, *ADVANCED PROBLEMS FOR COMPUTER MATHEMATICS* is just what you need!

Recommended for senior high, junior and community colleges; $2.00 per copy. Enclose payment with order to the Software Distribution Center, Bldg. 1-2.

NEW FROM HUNTINGTON

Two new Huntington II BASIC simulation programs for biology are now available, just in time for the new school year! A total of six simulations for biology have been published to date. Each program consists of the standard components (Teacher's Guide, Resource Handbook, Student Workbook and Paper Tape). See article in this issue entitled "Huntington Orders" for purchasing details.

POP

Subject Area: Biology, ecology

Grade Level: 10-12

Topic: Population growth modeling

Description: A series of three integrated programs which allow students with little math background to explore the simple models of growth of a gypsy moth population. Because of the current ecological interest in the gypsy moth as an important species with few natural enemies, POP is an ideal addition to current biology curricula.

MALAR:

Subject Area: Biology, social studies, health and ecology

Grade Level: 10-12

Topic: The eradication of malaria

Description: The student attempts to control a malaria epidemic. The program provides the context within which to study the biological, economic, social, political and ecological aspects of a classic world health problem.

SPECIAL FOR STUDENTS ONLY

If you are currently an elementary, junior or senior high school student, we've got a *DEAL* for you! People's Computer Company is offering a 50% reduction on subscription rates for this school year! You'll receive 5 issues of the PCC Newsletter for only $2.00!

Your subscription request must be on school letterhead stationery, signed by a teacher or administrator to certify your student status! Send payment with subscription today to:

People's Computer Company
P.O. Box 310
Menlo Park, CA 94025

Mention EDU!

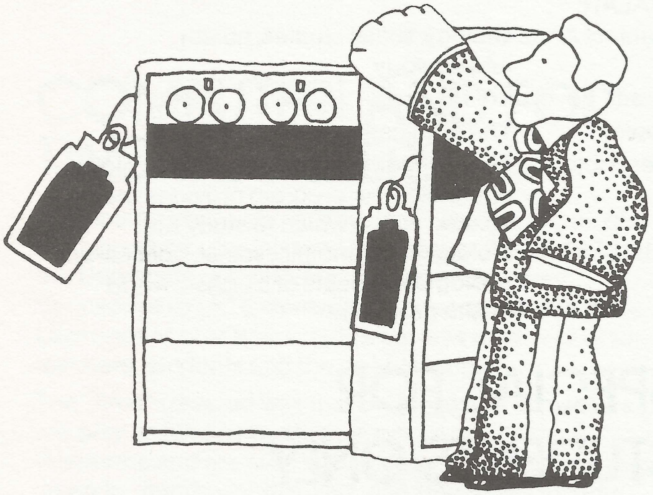
1973 SMALL COMPUTER HANDBOOK

This 500-page handbook contains all the latest information on the PDP-8/E, 8/F and 8/M processors and peripherals. Designed for use by engineers, technicians and programmers, the *Small Computer Handbook* is widely used in technical coursework in industry and educational applications.

The *Handbook* includes chapters on:

PDP-8/E Story
System Introduction
System Operation
I/O Operations
Processor Options
Internal I/O Options
External I/O Options
Installation Planning and Delivery
Omnibus Interfacing
I/O Expansion Techniques

To obtain a copy of the handbook, enclose $2 with order to Software Distribution Center, Bldg. 1-2.



SIMULATION REFERENCES

The May 1973 issue of *The Journal of Data Education* (journal of The Society of Data Education) ran a ten-page bibliography of good resources, readings, and articles... all related to simulations! So if simulating is your thing, make sure you snatch up a copy of this magazine!

Microfilm copies of *The Journal* are available from Xerox University Microfilms, Ann Arbor, Michigan 48106. Inquire about price. Tell them EDU sent you.

MORE SIMULATIONS

In social studies and business curriculum, computer simulations are enjoying exceptionally wide usage. Described here are two BASIC simulations, ideal additions to resource collections in both subject areas. Each package is complete with teacher's guide, student role booklets, scoring forms and documentation.

WHEELS

Level:	Senior H.S., Community/Junior College
Price:	$40.00
Description:	WHEELS is designed to provide students with experience in purchasing and maintaining a car successfully for one year. It may be used with an entire class, as an individual student assignment, or an out-of-class activity. Experience includes purchase of car, selection of method of financing, choice of insurance, provision for running expenses. The computer randomly assigns accidents, major repairs, unexpected events and calculates running expenses.

CHARGE

Level:	Senior H.S.
Price:	$15.00
Description:	CHARGE deals with the use and management of charge accounts. Built-in roles set financial conditions; the computer assigns positive and negative expected events. Participants purchase goods and services during a 12-month period and manage a Savings Account. Played by groups of 10 or less.

For more information contact:

Paul S. Amidon & Associates, Inc.
5408 Chicago Avenue South
Minneapolis, Minn. 55417

Mention EDU!

MEDIA MIX

Media Mix is an exciting eight-page newsletter published eight times yearly by Claretian Publications. Each issue is designed to bring ideas and resources for value education to classroom teachers and interested educators. *MM* contains lots of current information on television, films, sounds, books and games; low-cost and no-cost items available from government, industry and educational institutions are described in every issue!

Jeff Schrank, editor and free lance writer, has done an excellent job in creating a communication which is both timely and worthwhile!

Subscription for one year: $5.00. Mention EDU when you write to:

Claretian Publications
221 West Madison St.
Chicago, Illinois 60606

COMPUTERS AND CHEMISTRY

If you're just getting started with the computer in your chemistry classroom, or if you'd like some ideas for projects and exercises to enhance your current curriculum—you'll like our newly published volume entitled, *BASIC Application Programs—CHEMISTRY.* This 40-page booklet, sixth in the BASIC application series, contains twelve programs for use in the classroom or the lab. Geared toward the high school level, it has application for general science as well as junior and community college courses.

Each copy $1.50; payment must be enclosed with order to the Software Distribution Center, Bldg. 1-2.

CALL FOR EDUHELP

EDUHELP is the informal secondary school newsletter of the DECUS Educational Special Interest Group! As announced in EDU #8, this newsletter is designed to provide EduSystem users with timely and relevant information about other EduSystem users—their ideas, applications and needs. Two issues of the newsletter were published during the last school year. Membership in the EDUSIG organization guarantees each secondary user a subscription to EDUHELP. (Contact DECUS, Building 3-4 for application forms.)

EDUHELP needs contributions from you. Nothing is too big or too small. Send your ideas, articles, programs, or whatever strikes your fancy to the editor:

Chase Ambler
Asheville School
Asheville, N.C. 28806

Please help EDUHELP to help you!

COMPUTER MATH 1

Computer Mathematics I is a 40-page booklet designed as a two-week unit for introduction to computers. It's ideal as either a resource guide (for ideas!) or as a text for a beginning course in computer science or familiarization.

Computer Mathematics I, written by Dr. Eugene Smith of Wayne State University and Joseph Hersch of Post Junior High School (Detroit), has lots of interesting problems, exercises and ideas covering the topics of numbering systems, computer arithmetic, codes, programming and history of computing. Although it's designed primarily for use at the junior high and secondary level, this text has served as a resource manual for the elementary school computer program at Lexington H.S.

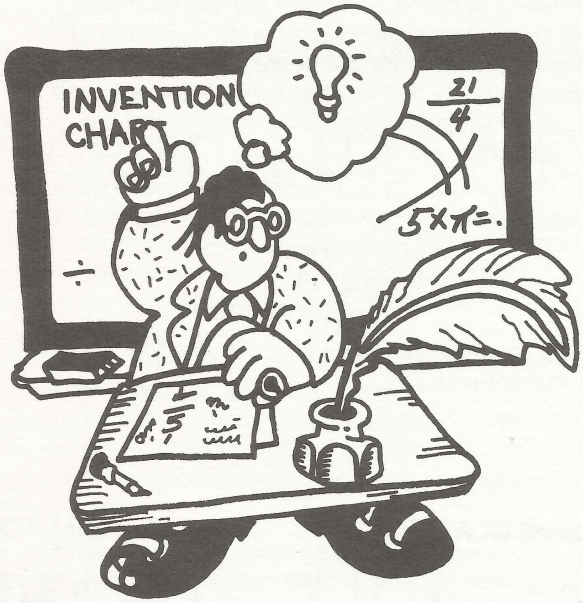
Both the text ($1.50) and teacher's guide ($3.00) may be obtained from:

MATH SHOP
5 Bridge St.
Watertown, MA 02172

Ask for the MATH SHOP's new catalog, too. It's terrific ...and mention EDU!

"If one computer can do the work of 50 employees, how many computers would it take to do the work of 20 underachievers?!"

IDEAS AT WORK



GREAT IDEAS

"Great ideas, it has been said, come into the world as gently as doves. Perhaps then, if we listen attentively, we shall hear, amid the uproar of empires and nations, a faint flutter of wings, the gentle stirring of life and hope. Some will say that this hope lies in a nation; others, in a man. I believe rather that it is awakened, revived, nourished by millions of solitary individuals whose deeds and works every day negate frontiers and the crudest implications of history. As a result, there shines forth fleetingly the ever threatened truth that each and every man, on the foundation of his own sufferings and joys, builds for all." (Taken from the writings of Albert Camus for the Christmas card of Dr. and Mrs. Richard Day of Phillips Exeter Academy, 1971).

HELPFUL HINTS

Here are some good hints from Chase Ambler, Asheville (NC) School, for teaching BASIC programming. Beginners or pros, teachers or students might find Chase's ideas valuable for the new year's work!

1. Liven up REM statements:
   Students enjoy a liberal application of humor to the otherwise drab subject of the REM instruction. For example,

```
100 REMEMBER THAT GERRY GENIUS WROTE THIS
100 REMARKABLE PROGRAM BY J. JONES
100 REMAIN COOL...THIS IS A GOODIE FROM H.SMITH
```

2. Use variables other than "X":
   The beginning Algebra I-type students "have an unfortunate fondness for the tail end of the alphabet." Encourage the early use of meaningful variables and literals such as
   "N" for number
   "G" for grade
   "C" for counter
   and so on. Remind them that subscripted variables can use any alphabetic character as subscript, i.e., A(N) or A(J) or A(I), etc.
3. Eliminate unnecessary GOTO statements:
   In many cases, the use of the "<>" sign will shorten program size if used instead of the popular "=" sign!
4. Use the first DIMmed variable:
   When using lists and subscripted variables, try making the 0 subscript the counter which contains the number of items in the list. For example, if A(J) has 7 items, A(1) through A(7), let A(0)=7. It makes documenting a much easier job!
5. Program too long?
   Delete REM statements, use multiple statements per line, abbreviate your BASIC instructions (PRI instead of PRINT) and remove imbedded blanks (GO TO can be written GOTO).

WALLS THAT TALK

The August, 1973, issue of *Nation's Schools* featured 'talking walls'...a craze that's catching on in schools across the U.S. "Walls that talk" are walls that are decorated with meaningful graphics...or fun graphics... symbols, letters or words that teach and show...and excite young minds!

Why not start with the computer room? Get your school's art director to design some super-graphics for the walls, the ceiling and floor(?)! Imagine computer critters like those featured in EDU #7 and EDU #8 leading kids down the hallways to the EduSystem!

And send photos of your final product to EDU!

THE NEWSPAPER GAME

The Newspaper Game was adapted from a game of the same name which appeared in the March 15, 1973 issue of *Media Mix*. (See article in this issue.) In keeping with the theme of this issue, this game may be used to launch discussions regarding careers in computers and journalism. Or it can be used to continue the inspiration of creativity (EDU #8 theme) and the reflection of values (EDU #7). Maybe you'll want to use *The Newspaper Game* to encourage improvement of your own school newspaper!

MATERIALS:
5 copies of today's newspaper
5 sheets of newsprint
5 pair of scissors
5 jars of paste

PREPARATION: Cut newsprint to size of front page of newspaper. Arrange class into 5 groups (may be uneven). Give each group one of each item under "Materials."

HOW TO PLAY: The object of the game is to have each group "print" a newspaper. Money is tight (so is the deadline!). Therefore, the newspapers must be reduced to ONE page by cutting articles from today's newspaper and pasting them on the newsprint.

When the new papers have been "printed," hang them on the classroom wall, identifying each one by group number. Select the winner by having each member of the class vote for the paper he or she would subscribe to, given the choice.

DISCUSSION: Follow the newspaper game with a discussion based on the following questions:

- How was it decided who would cut and who would paste?
- How were the articles chosen? By vote? One article per person? By one person only? (Ask the group to reflect on their own group's interaction.)
- Did the articles represent the values and interests of the group that "printed" the paper? Were the articles related by subject matter? Or did the articles represent samples of each type of article in the original paper? (Have each group reflect on the type of people in society that would be interested in its paper.)
- Which paper was the most creative in terms of (1) subject matter, (2) layout and (3) graphics? Which displayed the most originality?
- Why did one group win, rather than another? Did that group have more members? Did the boys and girls both like it?
- What is the "theme" associated with each paper? Do some have more feature stories than world events news, and vice versa?

ACTIVITIES:

1. Visit your local newspaper to find out how papers are really made.
2. Discuss careers in journalism and publishing.
3. Talk about the use of computers in the newspaper business.

GAMES COMPUTER BUMS PLAY

1. A 20,000 character tape must be punched by a computer whose high speed tape punch is not in operation. However, this tape can be punched in several segments, and the computer is linked to five terminals with paper tape punches. Two of the terminals punch at 10 cps, another two at 15 cps and the last one at 30 cps. Assuming that 300 null characters of leader and the same amount of trailer must be put on each tape, what is the shortest time the job can be done in?
2. C/O*M/P=C+O+M+P Each letter represents a unique digit from zero to nine. Find the value of each letter. Ignore reflections.
3. Calculate the length of a paper tape of outside diameter 6.000 inches rolled perfectly around the circumference of a cylinder which is 4.000 inches in diameter. The width of paper tape is 0.003 inches.
4. A computer programmer decides to go down to his office one Friday (four-day week) to catch up with his work. Halfway there he realizes that he left his briefcase at home and must go back for it. After he has arrived with his briefcase at the office, he finds that it has taken him an hour to get there. If he started at 40 kilometers per hour, returned home at 50 kph, and went the rest of the way at 45 kph, how far is his office from his home?
5. Using the data from the above problem find the average speed for the whole trip.

Note: These problems were written by students Steve Chalmers and Steve Wood for *COMP RANDOMLY*, Volume 6, April 1973. For information regarding the newsletter write to:

COMP RANDOMLY
3052 Warrington Rd.
Cleveland, Ohio 44120

FOURWAY

The Fourway problem was devised to illustrate two principles:

1. That a simple, well-defined procedure cannot be carried out manually, but requires a computer.
2. That such a procedure, programmed by a precise algorithm, is unpredictable in the sense that the person who writes the program cannot tell what will happen when it runs on the computer.

Consider the 3 x 3 form of FOURWAY. Given an array of nine cells:

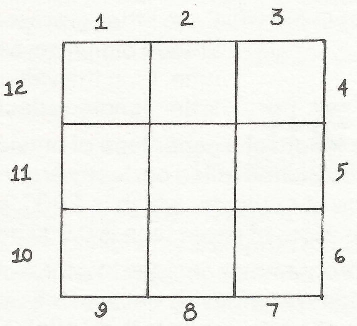


FIGURE 1

Each cell contains an integer in the range from 1 to 4. The number in the cell indicates the direction to be followed, according to the plan shown in Figure 2.

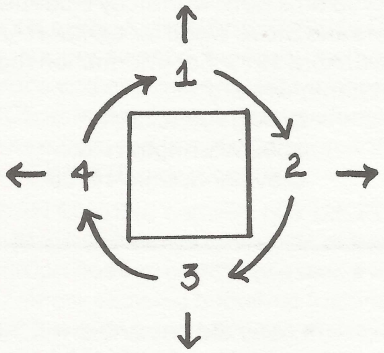


FIGURE 2

Thus, if the cell contains a 1, move North; if it contains a 2, move East; and so on. Each time a move is made out of a cell, the number in the cell advances as shown by the arrows in the circle; that is, 1 advances to 2; 4 advances to 1; and so on.

The nine cells all contain 1 to start. Play starts at the center cell. Moves are made from cell to cell until an escape from the array occurs, to one of the 12 exits numbered in the first diagram. A tally is made of the exit number, and a new play begins.

We now have the following problems:

1. Will each game, starting always at the center cell, eventually exit?
2. What will be the distribution of the tallies at the 12 exits after many games?
3. Will the pattern of numbers within the cells ever return to all 1's?

The 3 x 3 form can be analyzed completely by hand. The first play exits at 2; the second play exits at 3; the third play exits at 1. After 16 plays, the array will have returned to its original pattern, and the distribution of the exit tallies will be as shown in Figure 3.

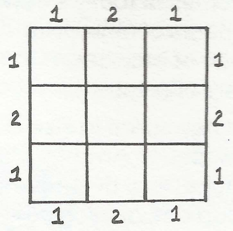


FIGURE 3

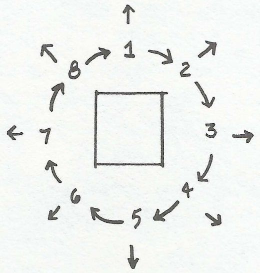


FIGURE 4

Using the computer, analyze the 5 x 5, 7 x 7 and 9 x 9 forms. How many plays does it take to return each form to the original pattern of all 1's?

What is the distribution of the 20 exit tallies in the 5 x 5 form at the end of the game?

As an extra challenge, try the game of EIGHTWAY. The move rule is shown in Figure 4.

Find the cycle lengths (number of plays to return each to all 1's) for the 3 x 3 and 5 x 5 forms.

Answers will appear in EDU #10. Send your computer solutions to EDU, Editor, FOURWAY, Education Products Group, 5-5, Digital Equipment Corporation, Maynard, MA 01754.

Note: This problem was adapted from the original which appeared in the third issue (June 1973) of *POPULAR COMPUTING*, a monthly newsletter published by author Fred Gruenberger. This newsletter contains many challenging problems for computer solution (as "FOURWAY" proves!), as well as book reviews and product analyses. Subscriptions are $15.00 per year ($12.00 if payment is enclosed). Order from POPULAR COMPUTING, Box 272, Calabasas, CA 91301.

Remember to mention EDU!

BUILD YOUR OWN DIGITAL CLOCK

The May 1973 issue of *Popular Electronics* contains a complete plan for building a clock that has a binary readout! What a way to get students to "think binary," not to mention the interest it would create. Foil patterns for the printed circuit boards are given. Parts include Motorola IC's and LED's.

Submitted by: Chase Ambler, Asheville School,
Asheville, N.C.

DO-IT-YOURSELF TEMPLATE

Hal Singer, Cabrillo Senior High School, Lompoc, CA sent us a great idea for the EduSystem 30 Batch BASIC template. Rather than purchasing enough templates for all of his classes, Hal used a box of standard data processing cards; he made one full column of punches near the center of each card and had students write the alphanumeric characters in the proper rows.

Hal's templates not only represent a cost savings for the school, but they provide a good learning exercise for his students. And the templates are disposable and easy to replace, too!

If you're using EduSystem 30 Batch BASIC, try Hal's idea!

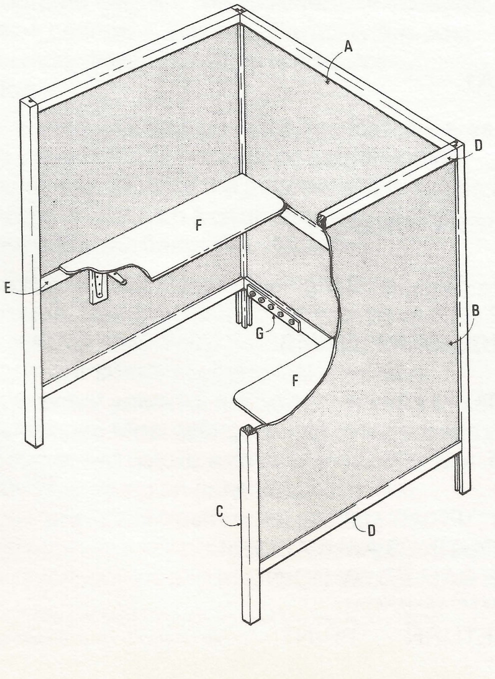
TELETYPE CARRELS

The following analyses and diagram depict a teletype carrel designed and constructed for use in Lexington High's Computer Lab. Using mini-mass- production techniques, we actually constructed eight carrels in about eight days, using the school shop to cut the materials, and using common hand tools to assemble the carrels in our lab.

Our configuration has 4 carrels facing 4 carrels, standing in the center of the room, with adjacent carrels bolted and the wires passing down the center of the configuration and under a walk-over to our computer.

All in all, we feel we have an attractive, functional, specialized resource center provided at a reasonable cost.

Good luck with yours!!



Key	*Description*
A	Back: ⅜″ x 3½′ x 4′ particle board
B	Sides: ⅜″ x 3½′ x 3½′ particle board
C	Uprights: 2″ x 3″ x 4′ K.D. Fir with ⅜″ dados
D	Cross Members: 2″ x 3″ (length cut to fit) K.D. Fir with ⅜″ dados
E	Cross Members: (Shelf support and strength) 1″ x 2″ common pine
F	Shelves: ¾″ x 9″ x 3′, plywood[3]
G	Wiremold Strip Receptacle

COST ANALYSIS[1]: (All costs approximated to nearest dollar)

Key	
A, B	2 sheets ⅜″ x 4′ x 8′ particle board[2]—$7.00
C, D	2″ x 3″ x 16′ K.D. Fir—$5.00
E	1″ x 2″ x12′ Common Pine—$1.00
F	¾″ x 9″ x 3′ Plywood shelves[3]—4.00
	1 pair 8″ x 10″ metal shelf brackets—$1.00
	Screws, nails, glue, paint and supplies—$2.00
G	Wiring, wiremold strip receptacle, plugs, extensions—$10.00
	12″ x 12″ carpet tiles, 60 tiles, interior walls only—$20.00

NOTE:

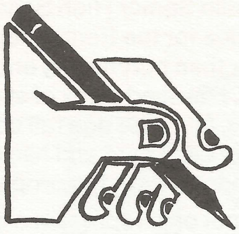
[1] Does not include labor costs.

[2] Building more than one carrel utilizes surplus materials.

[3] We found some unused hardwood library shelves which worked perfectly.

Submitted by: Clarence Good
Lexington H.S.
Lexington, MA 02173

PROGRAM OF THE MONTH - SUPER



"SUPER," written by T. A. Zank at District One Technical Institute, Eau Claire, Wisconsin, is used to solve various mathematics problems for electronics. The problems are selected from an option catalog containing such routines as "POLAR to RECTANGULAR CONVERSION"; "COMPUTE RESONANT FREQUENCY"; "OHM'S LAW", etc. "SUPER" runs on EduSystem 50 (TSS/8) with 24K and up to 16 users.

```
 10 PRINT "THIS SUPER PROGRAM SOLVES VARIOUS MATHEMATICS PROBLEMS FOR"
 15 PRINT "ELECTRONICS. ********* IF YOU NEED HELP TYPE 10. **********"
 20 PRINT "TO EXIT THIS PROGRAM TYPE 100.******"\PRINT\PRINT
 22 LET P=3.141593\LET J=0
 25 PRINT "OPTION";\INPUT O\PRINT
 30 IF O=1 THEN 100\IF O=2 THEN 200\IF O=100 THEN 800\IF O=3 THEN 300
 31 IF O=4 THEN 400\IF O=10 THEN 500\IF O=5 THEN 600\IF O=6 THEN 700
 32 IF O=9999 THEN 791
 35 PRINT "CAN'T FIND", O\PRINT\GOTO 25
100 PRINT "POLAR TO RECTANGULAR"\LET J=J+1
105 PRINT "ENTER FIGURES A<B"\PRINT "A";\INPUT A\PRINT "B";\INPUT B
107 LET B=B*(P/180)
110 LET B2=A*COS(B)\LET B4=A*SIN(B)
112 LET B5=ABS(B4)
125 PRINT "CONVERTED IS   "B2,\IF B4>0 THEN 140\IF B4<0 THEN 145
130 PRINT "J"B5
135 PRINT\GOTO 25
140 PRINT "+";\GOTO 130
145 PRINT "-";\GOTO 130
200 PRINT "RECTANGULAR TO POLAR"\LET J=J+1
205 PRINT "ENTER FIGURES A+OR-JB"\PRINT "A";\INPUT A\PRINT "B";\INPUT B
210 LET B2=SQR((A↑2)+(B↑2))
215 LET B4=ATN(B/A)\LET B4=B4*(180/P)
220 PRINT "CONVERTED IS   " B2"<"B4
225 PRINT\GOTO 25
300 PRINT "REACTANCE CALCULATION"\LET J=J+1
305 PRINT "XL OR XC? IF XL TYPE 1, IF XC TYPE 2"\INPUT A1
310 IF A1=1 THEN 320\IF A1=2 THEN 350
315 PRINT "CAN'T FIND", A1\PRINT\GOTO 305
320 PRINT "ENTER FREQUENCY IN HERTZ";\INPUT F1
325 PRINT "ENTER INDUCTANCE IN HENRIES";\INPUT L1
330 LET X1=2*P*F1*L1\PRINT "INDUCTIVE REACTANCE IS",X1,"OHMS"
335 PRINT\GOTO 25
350 PRINT "ENTER FREQUENCY IN HERTZ";\INPUT F2
355 PRINT "ENTER CAPACITANCE IN FARADS";\INPUT C2
360 LET X2=1/(2*P*F2*C2)\PRINT "CAPACITIVE REACTANCE IS",X2,"OHMS"
365 PRINT\GOTO 25
400 PRINT "RESONANT FREQUENCY CALCULATION"\LET J=J+1
405 PRINT "ENTER CAPACITANCE IN FARADS";\INPUT C3
410 PRINT "ENTER INDUCTANCE IN HENRIES";\INPUT L3
415 LET R5=1/(2*P*SQR(L3*C3))
420 PRINT "THE RESONANT FREQUENCY IS",R5, "HERTZ"\PRINT\GOTO 25
500 PRINT "THIS IS A CATALOG OF PROBLEM SOLVING ROUTINES AVAILABLE"
505 PRINT "IN THIS PROGRAM. THESE ROUTINES MAY BE CALLED BY DOING"
510 PRINT "THE FOLLOWING:**********************************************"
515 PRINT "        OPTION?(ENTER OPTION NUMBER) <RETURN>"\PRINT
```

```
520 PRINT “*****************CATALOG*************************”\PRINT
525 PRINT “ OPTION NO.        ROUTINE----------------------”
530 PRINT
535 PRINT “         1            POLAR TO RECTANGULAR CONVERSION”
540 PRINT “         2            RECTANGULAR TO POLAR CONVERSION”
545 PRINT “         3            COMPUTE REACTANCE (XL&XC)”
550 PRINT “         4            COMPUTE RESONANT FREQUENCY”
552 PRINT “         5            OHM’S LAW”
553 PRINT “         6            SQUARE ROOT TABLE”
555 PRINT “        10            LIST PROGRAM CATALOG”
560 PRINT “       100            EXIT PROGRAM”
563 PRINT “       9999           STATUS”
565 PRINT\PRINT\GOTO 25
600 PRINT “OHM’S LAW CALCULATION”\LET J=J+1
601 PRINT “UNKNOWN”;\INPUT U
605 IF U=1 THEN 630\IF U=2 THEN 660\IF U=3 THEN 690
610 PRINT “CAN’T FIND”,U,” IF E TYPE 1, IF R TYPE 2, IF I TYPE 3”
615 GOTO 601
630 PRINT “E=I*R”\PRINT “ENTER VALUES”\PRINT “I”;\INPUT I\PRINT “R”;
635 INPUT R\LET E=I*R\PRINT “E IS   ”E,“VOLTS”\PRINT\GOTO 25
660 PRINT “R=E/I”\PRINT “ENTER VALUES”\PRINT “E”;\INPUT E\PRINT “I”
663 INPUT I
665 LET R=E/I\PRINT “R IS   ”R,“OHMS”\PRINT\GOTO 25
690 PRINT “I=E/R”\PRINT “ENTER VALUES”\PRINT “E”;\INPUT E\PRINT “R”;
695 INPUT R\LET I= E/R\PRINT “I IS  ”I, “AMPS”\PRINT\GOTO 25
700 PRINT “SQUARE ROOT TABLE”\PRINT “TO WHAT NUMBER”;\INPUT W
702 LET E=0
703 IF W<101 THEN 705
704 PRINT “CAN’T GO TO   ”W\GOTO 700
705 FOR H=1 TO W
710 LET E=E+1\PRINT E,SQR(E)
720 NEXT H
790 LET J=J+1\PRINT\GOTO 25
791 PRINT “TOTAL JOBS PERFORMED THUS FAR:”,J\PRINT\GOTO 25
800 PRINT “EXIT”\PRINT
805 PRINT “TOTAL JOBS PERFORMED:”,J
810 PRINT\PRINT\PRINT “PLEASE LOGOUT WHEN DONE.”
999 END
```

PROBLEM OF THE MONTH

An innovative approach to the teaching of finite mathematical induction involves the use of an ancient mathematical game which has numerous titles including: The Tower Puzzle, the Tower of Hanoi, The Tower of Brahma, and the Hindu Pyramid Puzzle.

The puzzle consists of three dowels inserted in a wooden base and from five to seven graduated discs with center holes which permit the discs to be stacked on the dowels.

The object of the puzzle is to move the entire set of discs from the center tower to one of the other towers while conforming to the following rules:

(1) only one disc at a time may be transferred from peg to peg.
(2) a larger disc may never be placed atop a smaller disc.

The puzzle would appear to be an ideal activity for use on CRT terminals. Readers are invited to submit programs which will enable students to manipulate the “discs” on a CRT screen. The program should not permit illegal moves and might provide the option of using an alternate number of discs.

Assuming successful completion of this program, readers might also consider a computer solution to the problem which would enable students to observe the solution of the puzzle using n discs ($n > 1$). This solution should encourage students to generate the mathematical equation which determines the minimum number of moves necessary to transfer the set of discs between towers. This equation could then be verified via mathematical induction.

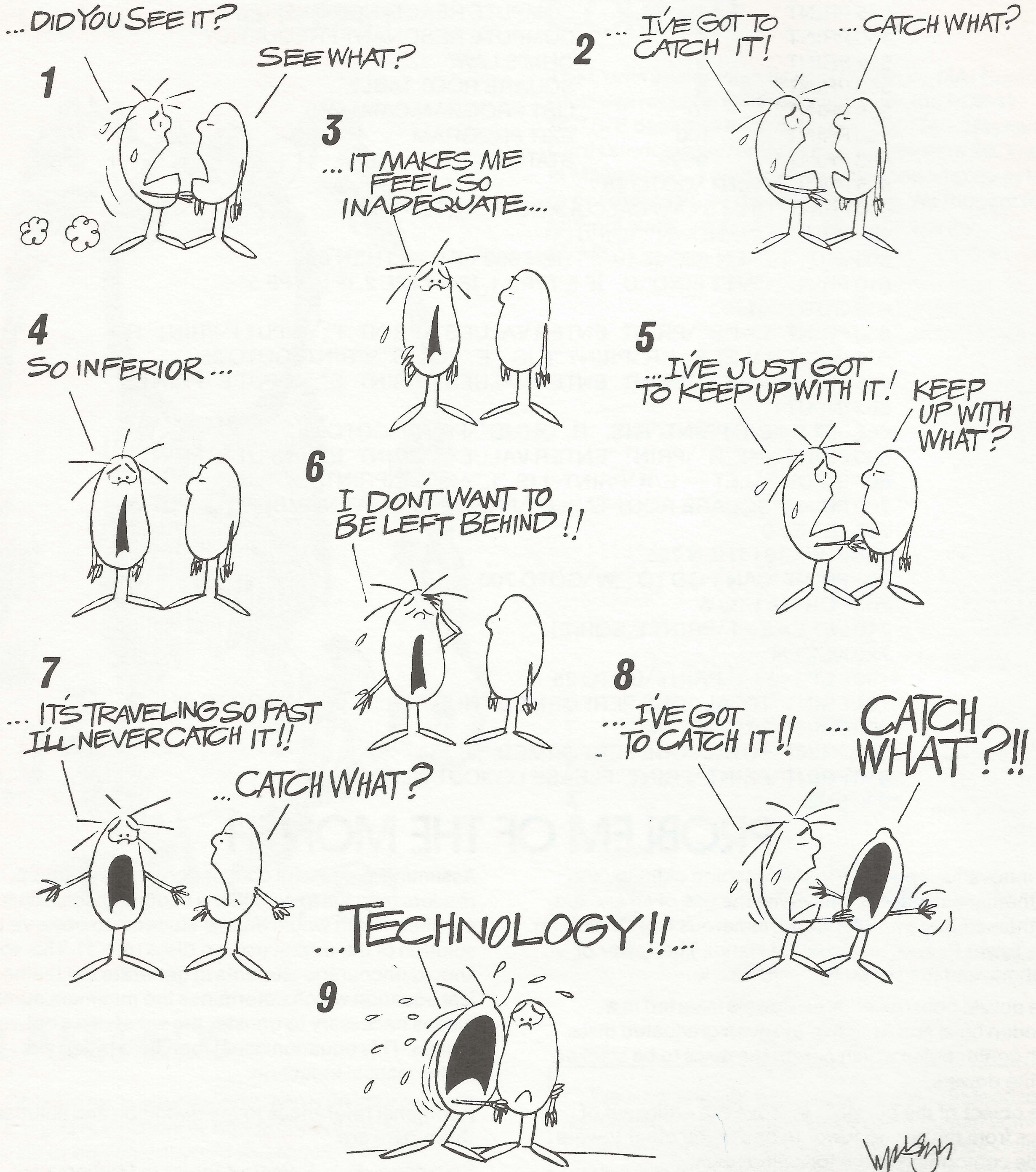
Additional references to the definition and solution of this puzzle are:

Spitznagel, E. L. *Selected Topics in Mathematics.* (137-142) Holt, Rinehart, and Winston, Inc. New York, N.Y., 1971.

Eisenburg, T. A., Van Beynen, J. G. “Mathematics Through Visual Problem”. *The Arithmetic Teacher.* Vol. 20, No. 2 (85-90), 1973.

The actual puzzle is available from several sources including the MATH SHOP, 5 Bridge St., Watertown, MA 02172.

IT'S CATCHING...


1
...DID YOU SEE IT?
SEE WHAT?
2
... I'VE GOT TO CATCH IT!
... CATCH WHAT?
3
... IT MAKES ME FEEL SO INADEQUATE...
4
SO INFERIOR...
5
... I'VE JUST GOT TO KEEP UP WITH IT!
KEEP UP WITH WHAT?
6
I DON'T WANT TO BE LEFT BEHIND!!
7
... IT'S TRAVELING SO FAST I'LL NEVER CATCH IT!!
... CATCH WHAT?
8
... I'VE GOT TO CATCH IT!!
... CATCH WHAT?!!
9
...TECHNOLOGY!!...

Reprinted from *Educational Technology*, March 1971

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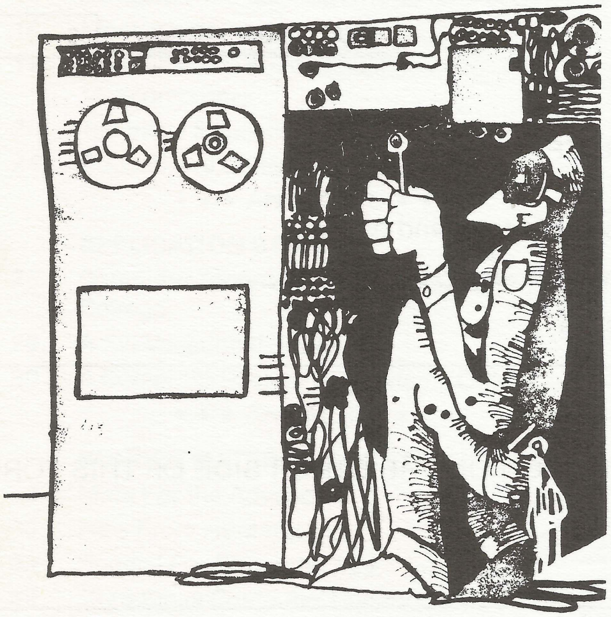

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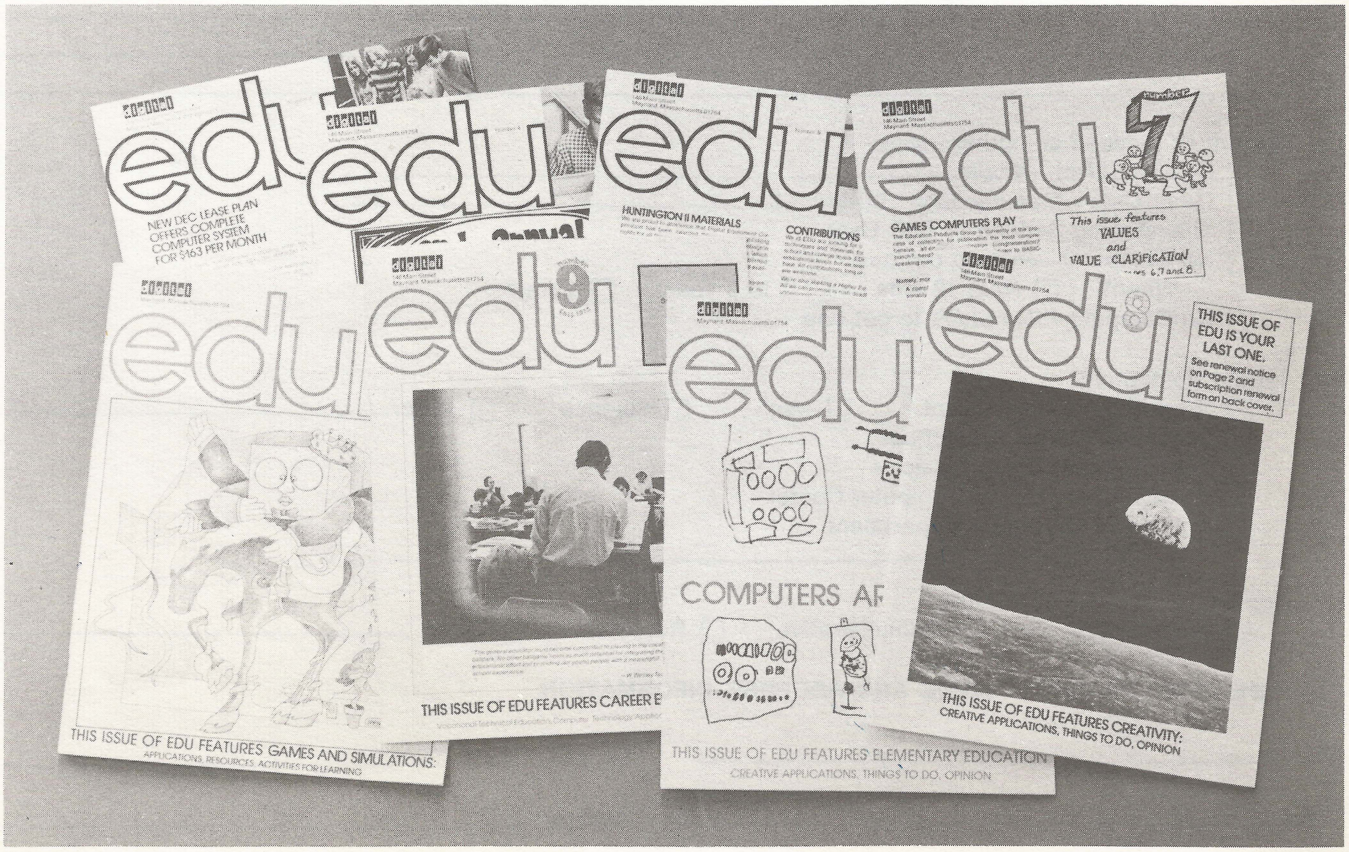
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			Letters to the Editor

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   - ☐

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   - ☐ Timesharing Service or RJE User
   - ☐ No Computer—Plan to get one
     When? ☐ Next 12 Mos. ☐ 1 to 2 years ☐ Longer
   - ☐ No Computer—No plans to get one

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